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Structural Studies of the Vulcanization of Rubber under Stretch[1]

E. A. Hauser and I. N. Smith[2]

JUST one hundred years have passed since the changes were discovered which rubber undergoes when mixed with sulphur and heated. Although "vulcanization," as this reaction and the changes subsequent thereto have been termed, must be considered the most important development in the rubber industry, we are still far from being in a position to offer a fully satisfactory explanation for this phenomenon. Nevertheless we have been able to improve our concept of these changes by the application of such modern methods of research as X-ray diffraction, and recent attempts to shed more light on the phenomenon from a strictly chemical point of view also have been successful.

The outstanding results of the latter work[3,4] are the definite proof that the changes in physical properties, which become noticeable during vulcanization, show no correlation with the amount of combined sulphur or with the total loss in unsaturation.

The experiments offered no direct experimental evidence as to the existence of specific chemical bonds or linkages in vulcanized rubber. However it could be definitely ascertained that chemical reactions involving the double bonds of the hydrocarbon and its combination with the vulcanizing agent, in one way or another, are necessary to produce a vulcanized structure responsible for the observed changes in properties.

On the basis of available data it appears that intermolecular sulphur linkages as a result of dehydrogenation of the rubber-molecule might be considered, at least in accelerated stocks, the most effective type of sulphur-combination in building up a vulcanized structure.[3,4,5] The other alternative, namely a straightforward polymerization reaction between the double bonds of neighboring rubber-molecules, does not seem to explain the optimum tensile-strength of the compounds studied.

In the case of soft vulcanized rubber it is today generally assumed that the sulphur bridging of adjacent hydrocarbon-molecules through cleavage of the double bonds takes place in such a manner that the molecules are still free to extend and become parallel with increasing tension.

On the basis of X-ray studies of rubber in unstretched and stretched condition, the assumption is today generally accepted that the long chain rubber molecules line up into a more or less parallel orientation during stretch and thus give rise to a so-called fiber pattern; whereas in unstretched condition random orientation must prevail. If vulcanization is primarily due to sulphur bridging of adjacent hydrocarbon molecules, then vulcanization of rubber under stretch should reveal results which should materially add to our present structural ideas of vulcanized rubber.

The literature on this subject seems to be limited to two U. S. patents.[6] W. F. Busse obtains a very tough, fibrous rubber, extremely resistant to extension and rupture by stretching rubber short of its normal breaking point and then subjecting it to the action of an appropriate vulcanizing agent, such as sulphur chloride vapor. Although the patent mentions vulcanizing temperatures from 0-85° C., low temperatures are preferred because the plastic flow of the rubber is then less and the true elongation attainable is greater. Masticated rubber can only be used if given a preliminary vulcanization to overcome the plasticity inherent to unvulcanized milled rubber. According to the patent, so treated rubber (the best results are obtained with dried latex-rubber sheets) exhibits a pronounced X-ray fiber diagram.

J. W. Schade's patent differs from the above one by vulcanizing rubber under such physical stress that the resulting product still retains elasticity. Such rubber will show an ultimate elongation reduced by an amount roughly proportional to the elongation applied during vulcanization. The rubber exhibits a much higher modulus

[1] Presented at the ninety-eighth meeting of the American Chemical Society, Division of Colloid Chemistry, held Sept. 11, 1939, at Boston, Mass.
[2] Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, Mass.
[3] J. R. Brown and E. A. Hauser, *Ind. Eng. Chem.*, 30, 1291 (1938).
[4] E. A. Hauser, and J. R. Brown, *Ind. Eng. Chem.*, 31, 1225 (1939).
[5] A. van Rossem, *India Rubber J.*, 92, 847 (1936).
[6] W. F. Busse, U. S. patent No. 1,909,455; J. W. Schade; U. S. patent No. 2,059,284.

than the same compound, if vulcanized under normal conditions. This patent, too, uses desiccated latex rubber sheets as most satisfactory. It also refers to the necessity of prevulcanization, if milled rubber is to be used. The maximum stretch during cure, as referred to in this patent, is 400%. Vulcanization according to Schade's process was carried out at temperatures between 135-146° C. in open steam. The patent contains no reference to results of X-ray diffraction, and none of the two patents gives any indication as to the amount of combined sulphur or related chemical data.

For the purpose of obtaining such information the following two compounds were prepared:

COMPOUND A

Ingredient	Parts by Weight	Function
Latex 60%	167.00	Rubber
Zinc Oxide	2.00	Activator
Sulphur	1.00	Curing Ingredient
Butyl Zimate	1.00	Accelerator
Darvan No. 1	0.16	Dispersing Agent
Casein	1.00	Stabilizer
Caustic Soda	0.15	Casein Solvent
Beta Naphthol	0.01	Preservative
Water	8.01	Medium

COMPOUND B

Latex 60%	167.00	Rubber
Zinc Oxide	2.00	Activator
Sulphur	5.00	Curing Ingredient
Butyl Zimate	1.00	Accelerator
Darvan No. 1	0.32	Dispersing Agent
Casein	0.24	Stabilizer
Caustic Soda	0.10	Casein Solvent
Water	7.34	Medium

The compounding ingredients in paste form, as well as the latex, were mixed thoroughly by prolonged rolling of the container in a room refrigerated to 10° C. The compounds were then poured on to a glass plate on which glass strips had been cemented to form a frame. The films were dried at normal room conditions until they could be removed and hung into a vacuum desiccator in the refrigerated room. After five days standard test pieces were stamped out and marked and then kept in the desiccator until ready for cure. Since previous work on the

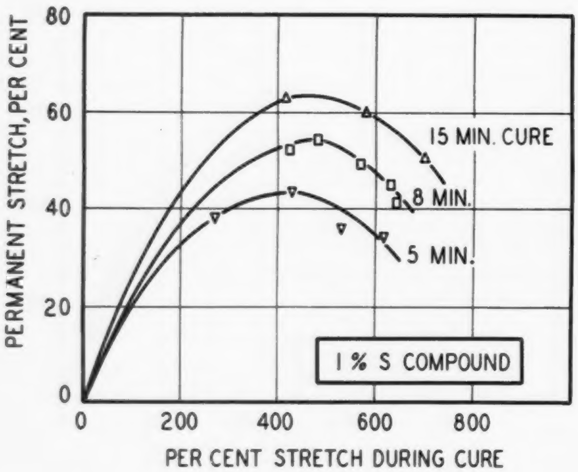


Fig. 1

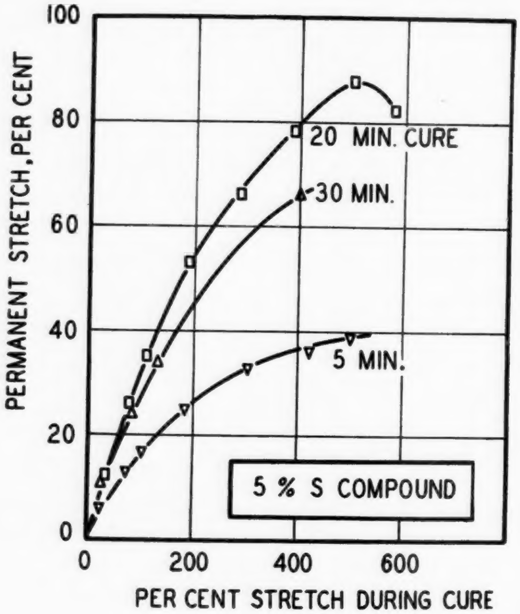


Fig. 2

vulcanization of latex compounds had demonstrated that the rate of vulcanization of liquid latex compounds at temperatures below 10° C. is practically negligible and that vulcanization proceeds extremely slow when drying vulcanizable latex compounds at room temperature, the procedure as outlined seemed satisfactory for the purpose.

The test specimens were fixed between clamps of an appropriate stretching machine, rapidly stretched to the desired elongation, and the whole apparatus was immediately submerged into boiling water. At the termination of the desired time of cure the apparatus was removed and plunged into ice water. Then the samples were removed, wiped dry, and returned to the vacuum desiccator, held at 10° C.

Prior to testing the samples for permanent set, tensile strength, and modulus on a standard Scott tensile tester, they were brought to room temperature.

Combined sulphur determinations were carried out by subjecting the samples for sixteen hours to extraction with cold acetone followed by eight hours' hot extraction.[7] The total sulphur was determined on the remaining rubber.[8]

The results obtained with Compound A for the permanent set versus elongation during cure and for different times of cure are plotted in Figure 1. The results obtained with Compound B are represented in Figure 2. Figure 3 demonstrates the changes in tensile strength and modulus and combined sulphur with varying elongations during cure for Compound A; whereas Figure 4 shows the data obtained with Compound B.

The following facts become immediately noticeable: (1) The permanent set exhibits a maximum if the elongation during cure is about 500%. This seems to be independent of time of cure with compounds containing small amounts of sulphur. Compounds containing high amounts of sulphur (for an accelerated soft rubber compound) exhibit the same maximum only for the time resulting in optimum cure. (2) The tensile strength drops with increasing elongation during cure. The modulus at the point of maximum permanent set is either at a minimum, or be-

[7] C. H. Lindsley, *Ind. Eng. Chem.* (*Anal. Ed.*), 8, 176 (1936).
[8] *Vanderbilt News*, 8, 2, 20 (1938).
[9] All tensile and modulus figures are based on the cross-sections of the original test pieces.

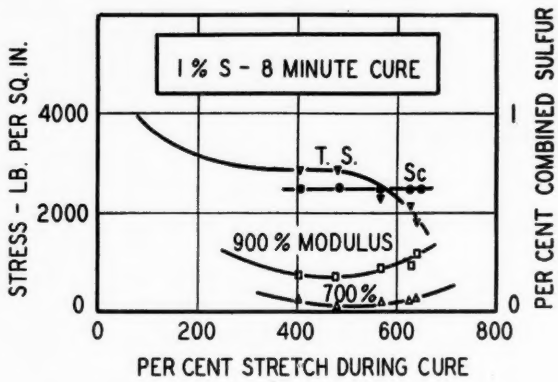


Fig. 3

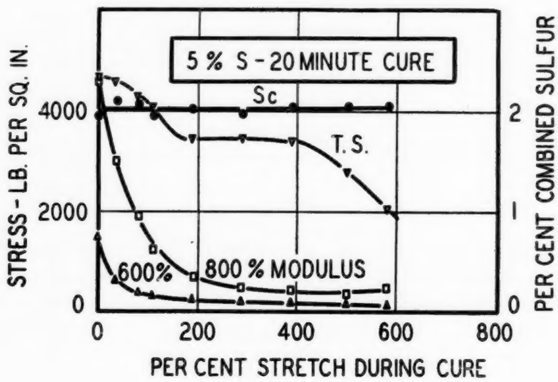


Fig. 4

comes constant from this point on.[9] (3) The combined sulphur for a given time of cure is independent of elongation during cure.

All vulcanized samples were submitted to X-ray diffraction analysis. However no signs of a fiber pattern could be detected, even with those samples which were cured either under conditions resulting in maximum permanent set, or at a maximum elongation during cure.

Since the recorded permanent sets after cure seemed unexpectedly low, analysis for combined sulphur of the dried, but unvulcanized test slabs were made which revealed a combination of sulphur of 0.14%. To decide if this combination affects the results, test slabs of Compound A were made, but this time the films were not only poured, but also dried in a refrigerated room at about 10° C. Curing and testing were carried out as discussed before. The results obtained are plotted in Figure 5. In this case we find that the permanent set seemingly also tends toward a maximum, but the attainable elongation was insufficient actually to demonstrate such maximum. The tensiles first drop rapidly, approaching constant values at higher elongation during cure, and the same can be said for the modulus.

In this series, also no indication of a fiber diagram could be obtained by X-ray diffraction. However if those samples, which were cured at medium elongations and had retained a certain amount of elasticity, were X-rayed while kept under tension, they showed very sharp fiber patterns.

Discussion of Results

The fact that none of the vulcanized samples revealed even the faintest traces of an X-ray fiber diagram proves beyond doubt that no preferential orientation of the molecules can exist. Since it is known that unvulcanized rubber, if stretched to only a few hundred per cent., shows a preferred orientation of its molecules and since stretched rubber, if vulcanized in sulphur chloride vapors, according to Busse, also exhibits an X-ray fiber diagram, we must assume that a rearrangement of the parallel oriented molecules into random orientation takes place during vulcanization at temperatures above 100° C.

The fact that rubber cured at maximum elongations shows a high permanent set without revealing preferred molecular orientation can be explained by assuming that the molecules due to their appreciable thermal oscillation at vulcanizing temperature are fixed in an entangled position by the sulphur linkages, thus retaining the elongation of the sample, but without preferential orientation.

If the rubber is already prevulcanized to some degree prior to final cure in an elongated condition, we must naturally take the existing linkages into consideration. At maximum elongations during cure these pre-existing linkages will add their retracting tendency to the effect of thermal oscillation, thus causing a fixing of the molecules by the added sulphur linkages in such a position that contraction will become clearly noticeable upon release of the tension. At medium elongations during cure the added sulphur linkages will balance the influence of the pre-existing linkages or even become predominant because at this stage molecular elongation has not yet reached the point where the tendency to contract is as pronounced as in the previous case.

The more or less constantly decreasing tensile strength with increasing elongation during cure is to be expected since the molecules will transfer the applied force the easier to the weak spots of the system the more extended they are.

No explanation can be offered for the discrepancy of tensile strength data as reported above and those reported by Schade.

The results substantiate the contention that the changes rubber undergoes during vulcanization are primarily due to intermolecular sulphur linkages.

Our thanks are due to the R. T. Vanderbilt Co. for supplying us with the vulcanizing dispersions used throughout this investigation.

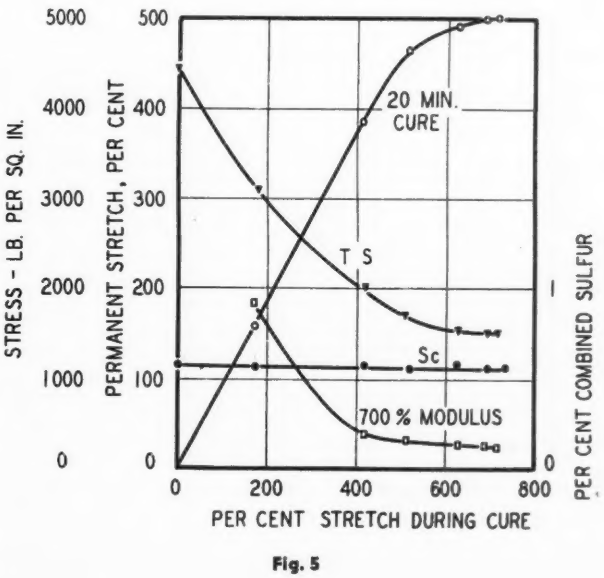


Fig. 5

A Critical Analysis of the T-50 Test for State of Vulcanization[1]

George R. Vila [2]

IN 1938 the rubber industry was the fourteenth largest in the United States, employing approximately 130,000 people. The eminent position which it has assumed dates from the discovery of vulcanization. Before this discovery rubber was of comparatively little commercial importance. For one hundred years the principles and basic technique of vulcanization have not changed. Today, as one hundred years ago, rubber is transformed to its most useful state by the addition of sulphur and the application of heat. It may safely be said that vulcanization is the foundation of the modern rubber industry. Consequently its technical application and control are of vital importance.

State of Cure

In formulating a rubber compound for a specific purpose those ingredients are chosen which will give the desired properties in the finished product. The compound then is vulcanized in order to develop those properties to their maximum extent.

Vulcanization is progressive and may be carried to any desired state by controlling the time and temperature at which it is effected. For any rubber stock, compounded for specific properties, there is a state of vulcanization or cure which brings these properties out to their fullest degree. As every rubber technologist knows, no rubber concern can hope to remain long in business without exercising strict control over the state of cure to which it brings its products.

State of cure indicates the position of a cure in a series of progressive cures. It may be represented schematically by Figure 1 as a function of the time of vulcanization carried out at a constant temperature.

As illustrated in Figure 1, the progressive states of cure are: *Undercure; Optimum Cure,* as judged by maximum tensile strength after aging; *Maximum Cure,* as judged by maximum tensile strength before aging; *Overcure;* and *Reversion,* or extreme overcure.

Tests for State of Cure

With such wide variation in physical properties for different states of cure, it is not surprising that the rubber industry has expended a great deal of effort in developing tests for indicating state of vulcanization.

In various factories and laboratories at one time or another the following tests have been used:

1. Per cent. sulphur combined with rubber.
2. Maximum tensile strength or tensile product.
3. Maximum stress for a given strain or modulus.
4. Optimum resistance to aging.
5. Specific properties for special service requirements: i.e., cold flow, hardness, etc.

The above tests have been of immense value, and every technical man in the rubber industry is familiar with the significance and limitations of each.

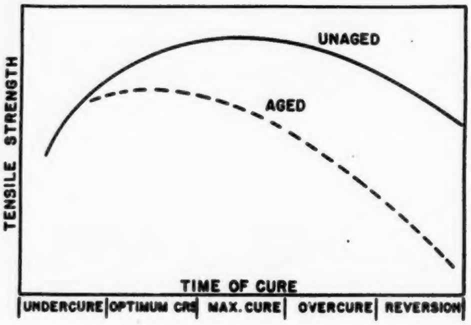


Fig. 1

In recent years a new method, known as the T-50 test, has been adopted in an increasing number of laboratories for indicating state of cure. Several articles have appeared in the literature, and it is the purpose of this paper to analyze critically the data which have been published and to determine the relative merit of this test in comparison with the older methods. New data have been obtained where it was believed that published data were not sufficient to arrive at a clear conclusion.

The T-50 Test

Basically the T-50 is a quantitative measure of the extent of immunity of a rubber compound to the effects of temperature changes. Prior to the discovery of vulcanization the commercial use of rubber was limited because it became brittle at freezing temperatures and soft and tacky at around 100° F.

As has been stated, the discovery of vulcanization was the realization that the addition of sulphur to rubber under the influence of heat greatly decreased its sensitivity to temperature changes. It was only natural that this phenomenon ultimately would be investigated quantitatively. Probably it was not undertaken until recent years because of no easy laboratory method for chilling rubber much below 0° C. until dry ice became readily available.

Gibbons, Gerke, and Tingey[3] first announced the T-50 test, and their article gives an excellent account of the fundamental principles which led to its development. They found that unvulcanized rubber, stretched and frozen at a low temperature, would, upon gradual heating, retract to 50% of its initial elongation at 18° C. Upon investigating the behavior of cured rubber under similar conditions, it was discovered that it too would retract to 50% of its initial elongation at some temperature proportionately lower than 18° C., depending upon how far vulcanization had progressed.

Based on this principle, a suitable apparatus was designed, and specifications were set up for performing the T-50 test. Acetone was used as a cooling medium and was chilled to −70° C. by circulation through a coil sur-

[1] Presented before the New York Group, Division of Rubber Chemistry, American Chemical Society, October 20, 1939, as winner of first prize in the Essay Contest sponsored by the New York Group.

[2] Naugatuck Chemical Division of United States Rubber Co., 1790 Broadway, New York, N. Y.

[3] "The T-50 Test for State of Cure." Gibbons, Gerke, and Tingey, *Ind. Eng. Chem. (Anal. Ed.)*, 5, 4, 279 (1933).

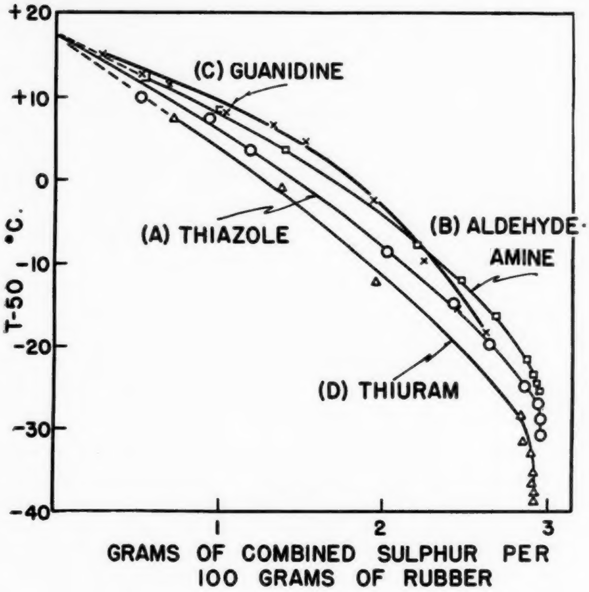


Fig. 2

rounded by dry ice. Stretched samples immersed in the cold acetone bath remained elongated and retracted gradually when the bath was warmed with an electrical immersion heater. The temperature at which the samples had retracted to 50% of their initial elongation was noted and recorded as the T-50 value. It was found that the T-50 temperature became progressively lower with advancing state of cure, being 18° C. for unvulcanized rubber and approximately 13° lower for each per cent. of sulphur which had combined with the rubber. Thus for a compound which had 1% combined sulphur the T-50 would be approximately 18° minus 13°, or 5° C. Likewise, for 2% combined sulphur the T-50 would be approximately -8° C.

T-50 and Combined Sulphur

Rubber technologists long have associated per cent. of combined sulphur with state of cure. Although this method has many shortcomings, it has proved to be a practical criterion and is preferred in many laboratories. Inasmuch as the per cent. of combined sulphur increases and T-50 decreases as cure progresses, it is natural to ask if a quantitative relation exists between them.

Gibbons, Gerke, and Tingey[3] found the approximate relation stated in the preceding section. This relation was studied, however, in greater detail by Gibbons, Gerke, and Cuthbertson[4] with the following conclusions:

1. For vulcanizates which contain no zinc oxide, but vary in composition otherwise, there is a definite relation between T-50 and combined sulphur for all compounds.

2. For vulcanizates which contain zinc oxide, but vary in composition otherwise, no general relation exists between T-50 and combined sulphur for all compounds. In this case the relation was found to vary according to the type of acceleration. No better correlation is obtained even though the combined sulphur data be corrected for that portion of the sulphur which combined with the zinc as zinc sulphide.

3. For vulcanizates which contain zinc oxide, a definite relation exists between T-50 and combined sulphur for each compound.

Although the reference[4] cited above is an excellent piece of work, it left some questions unanswered which are believed essential for the present analysis.

Consequently a series of compounds were mixed (see Table 1) in which the acceleration was varied to include one of each type in common use: namely, a thiazole, an aldehyde amine, a guanidine, and a thiuram. This series was as follows:

TABLE 1

Recipe	Parts by Weight A	B	C	D
Smoked Sheet	100	100	100	100
Zinc Oxide	10	10	10	10
Stearic Acid	2	2	2	2
Sulphur	3	3	3	3
Zinc Salt of Mercaptobenzothiazole	1	..	..	..
Butyraldehyde-aniline Condensate	..	1	..	..
Diphenyl Guanidine	..	..	1	..
Tetramethylthiuram Monosulphide	..	..	..	0.2

Samples were cured in a press over a range of time at 30 pounds' steam. Several long overcures were included purposely in order to determine how T-50 values progressed in this respect. T-50 and combined sulphur determinations were made on each sample. Also physical tests were secured with a Scott stress-strain machine using dumbbell test pieces. The results obtained are tabulated in Table 2.

TABLE 2

Recipe	Cure Minutes at 274° F.	Combined Sulphur g/100G. Rubber	T-50 °C	T-50 °R	500% Modulus Lbs./Sq. In.	700% Modulus Lbs./Sq. In.	Tensile Strength Lbs./Sq. In.	Elongation at Break %
A	5	0.54	10.2	283.2	010	130	590	946
	10	0.95	7.5	280.5	200	530	1650	903
	15	1.19	3.6	276.6	260	1050	2920	903
	30	2.03	— 8.8	264.2	440	2070	3310	810
	45	2.44	—15.0	258.0	540	2120	3320	803
	60	2.65	—20.0	253.0	660	2300	3450	800
	90	2.87	—25.1	247.9	620	2480	2980	753
	120	2.95	—27.1	245.9	560	2050	3120	796
	150	2.96	—29.0	244.0	600	2160	3200	786
	180	2.96	—30.9	242.1	600	2220	2940	763
B	5	0.56	12.4	285.4	050	140	900	1103
	10	1.02	8.6	281.6	270	900	2500	896
	15	1.41	3.9	276.9	430	1790	3620	830
	30	2.21	— 7.8	265.2	900	3320	4200	770
	45	2.49	—12.2	260.8	950	3750	4320	743
	60	2.69	—16.7	256.3	990	3840	4190	723
	90	2.89	—22.0	251.0	980	3700	4080	730
	120	2.92	—23.9	249.1	830	3470	3880	740
	150	2.94	—24.8	248.2	800	3310	3780	720
	180	2.96	—25.5	247.5	730	2910	3530	723
C	5	0.30	15.5	288.5	...	...	50	976
	10	0.54	12.9	285.9	...	130	660	1173
	15	0.70	11.6	284.6	020	220	940	1013
	30	1.04	8.4	281.4	200	690	2090	926
	45	1.34	6.8	279.8	200	940	2380	883
	60	1.54	4.7	277.7	330	1190	2560	856
	90	1.96	— 2.5	270.5	620	2180	3200	783
	120	2.26	— 9.8	263.2	550	2380	3470	790
	150	2.47	—15.8	257.2	860	3060	3600	753
	180	2.64	—18.7	254.3	700	2950	3510	746
D	5	0.73	7.8	280.8	020	150	380	886
	10	1.39	— 1.0	272.0	410	1750	3760	863
	15	1.96	—12.4	260.6	730	2780	4190	793
	30	2.85	—28.5	244.5	750	3040	3980	763
	45	2.87	—31.8	241.2	780	2860	3710	766
	60	2.92	—33.0	240.0	520	2400	3590	786
	90	2.93	—35.5	237.5	680	2120	3300	776
	120	2.92	—36.9	236.1	500	1740	3230	816
	150	2.93	—38.0	235.0	600	1940	2840	770
	180	2.92	—38.9	234.1	480	1830	2970	776

The relation between T-50 and combined sulphur for each of the accelerators studied is brought out clearly in Figure 2.

It is evident that basic types of accelerators, such as a guanidine or an aldehyde amine, give higher T-50 readings for a given amount of combined sulphur than do acidic types, such as a thiazole or a thiuram. The extent of this variation is indicated in Table 3.

TABLE 3. T-50 FOR A CONSTANT AMOUNT OF COMBINED SULPHUR WITH VARIOUS TYPES OF ACCELERATORS

Pts. Sulphur Combined with 100 Pts. Rubber	Guanidine	Aldehyde-Amine	Thiazole	Thiuram
1	9.3	8.3	5.8	4.0
2	—3.0	—4.6	—8.2	—11.6

[4] "The T-50 Test for State of Vulcanization, II." Gibbons, Gerke, and Cuthbertson, "Proceedings of the Rubber Technology Conference," p. 861.

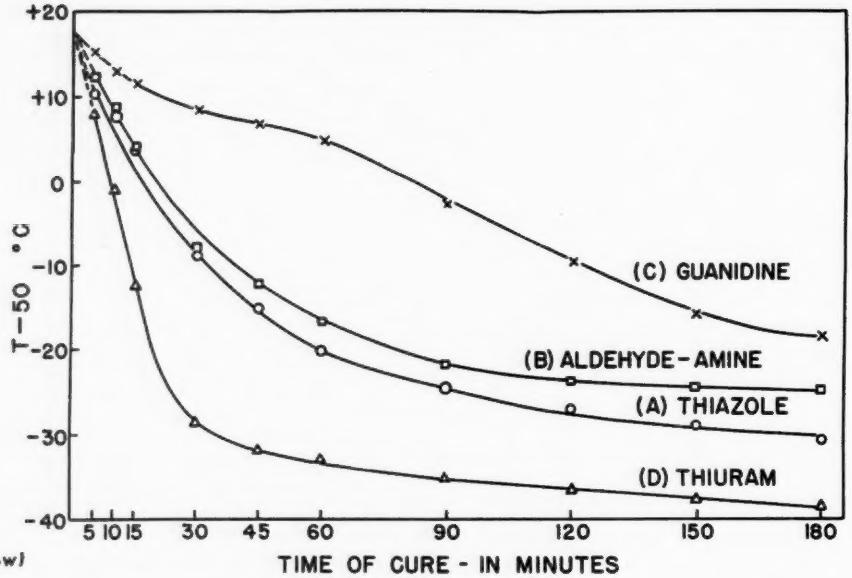
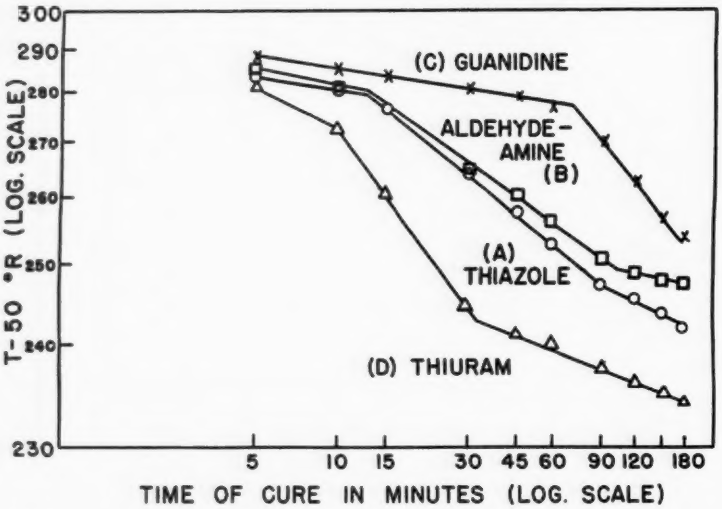


Fig. 3

Fig. 4 (Below)



T-50 and State of Cure

The T-50 test was designed to indicate the relative state of cure of a compound. Figure 3 shows the variation of T-50 with time for cure for compounds A, B, C, D. (Table 1).

The above curves are characteristic and bring out the fact that, as the state of cure progresses, T-50 values continue to decrease. The form of these curves suggested plotting the data on logarithmic scales, and a very interesting relation was found, as shown in Figure 4 where the logarithm of the T-50 expressed in absolute temperature is plotted against the logarithm of the time of cure in minutes.

For a given amount of combined sulphur the lowest T-50 value appears to be obtained with a thiuram type of accelerator. This may explain why thiurams are preferred for producing stocks with minimum cold flow characteristics.

Further study of Figure 2 reveals that in prolonged overcures T-50 values continue to become lower, at a decreasing rate, after combined sulphur remains virtually constant. This is in agreement with data reported by Somerville.[5] It would appear that the T-50 test records the effect of those factors which contribute to vulcanization even after all available sulphur has been consumed. Tuley[6] has referred to these factors collectively as "Vulcanization Potential."

The data of Gibbons, Gerke, and Cuthbertson and the present study indicate, then, that no general relation exists between T-50 and combined sulphur. A specific relation, however, exists between these properties for any one compound. For practical purposes, however, it may be stated that the approximate relation of a decrease of 13 degrees in T-50 for each per cent. of combined sulphur applies in a very general way within the normal curing range. This is subject, however, to a possible error of from 10 to 40%.

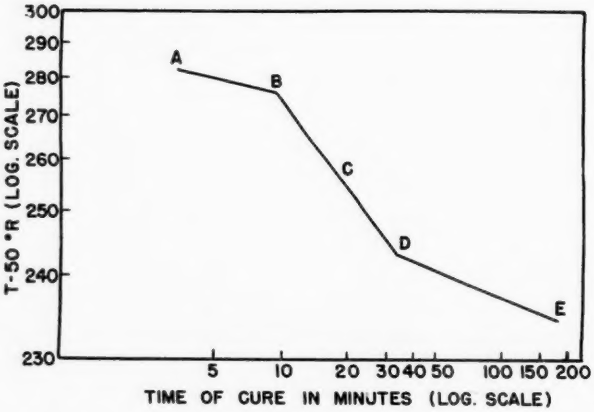
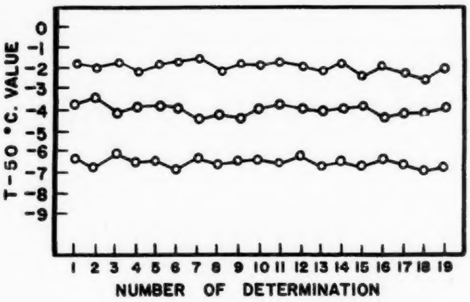


Fig. 5

All the T-50 data reported in the literature were

[5] "Some Properties of Two Vulcanized Pure Gum Compounds at Low Temperature." Somerville, "Proceedings of the Rubber Technology Conference," p. 773.

[6] "Rubber Compounding with the T-50 Test." Tuley, INDIA RUBBER WORLD, 97, 1, 39 (1937).



Top line—Slow rate of vulcanization.
Center line—Medium rate of vulcanization.
Third line—Fast rate of vulcanization.
Compound No. 1 vulcanization 60' at 30 lbs.

Fig. 6 (From Roberts)

plotted, as above, on log-log paper, and the same characteristic relation was found. The data for each accelerator are seen to fall on three straight lines which vary in slope. This suggests three distinct stages of vulcanization. When the three portions of the plot are correlated with physical properties, the first portion is seen to correspond with undercures. The second line, of maximum slope, corresponds to those cures which lie within the limits of maximum physical properties. Overcured stocks fall on the third portion of the line. There seems to be evidence that, in some stocks at least, the cure which gives optimum aging occurs at the first break in the line. Perhaps minimum cold flow would be found at the second break.

These observations are represented schematically in Figure 5.

Undercures fall on line AB. Maximum cures fall on line BCD. The highest physical properties frequently fall near point C which lies about midway between B and D. As stated above there is some evidence that the cure which gives optimum aging may fall at point B. Overcures fall on line DE.

The curing range of a compound appears to be in proportion to the slope of the second part of the line (BCD). Note the comparison in Figure 4 between the line for the thiuram-type accelerator, which has a short curing range with normal sulphur, and those for the zinc salt of mercaptobenzothiazole and butyraldehyde aniline, which have long curing ranges.

It is believed that the above observations should be confirmed on a larger number of stocks. Perhaps the plotting of T-50 data on log-log paper would bring pertinent properties of a compound into sharper focus which would be of immense practical value. There also appear to be interesting possibilities in studying these facts in relation to various vulcanization theories. Inasmuch as T-50 decreases with progressive state of cure, it may be considered an index of the extent to which vulcanization has taken place. The relation shown above between T-50 and time of cure may be expressed mathematically as

$\log \text{T-50} = K \log t$

where T-50 is expressed in absolute temperature, °R., and t is the time of cure in minutes.

K = a constant, which is proportional to the slope of the line.

This equation is characteristic of a first order reaction. The present data suggest that vulcanization takes place in three stages, all of which are reactions of the first order.

[7] "Use of T-50 Test for Evaluating the Rate of Vulcanization of Carbon Gas Black Stocks." Roberts, "Proceedings of the Rubber Technology Conference," p. 506.

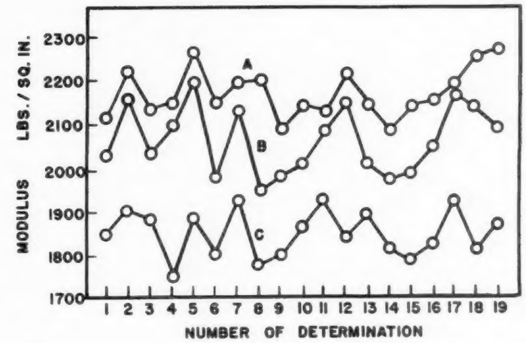


Fig. 7

T-50 and Physical Properties

The relation between T-50 and physical properties: namely, tensile strength and modulus, has been studied by Roberts[7] in an excellent article entitled: "Use of T-50 Test for Evaluating the Rate of Vulcanization of Carbon Black Stocks." He used essentially the same method and apparatus as employed by Gibbons, Gerke, and Tingey[8], although some minor changes and improvements are described.

An analysis of this data shows the T-50 test to be very sensitive in detecting differences between curing rates of different carbon gas blacks. The T-50 data correlate well with physical properties, but are much more sensitive and reproducible within closer limits than are the stress-strain data as shown by a series of 19 different rubber tests made by Roberts on slow, medium, and fast-curing carbon gas black samples in the following test recipe.

Table 4. Compound No. 1 (Roberts)

Smoked Sheet	100
Carbon Black	50
Pine Tar	3.50
Stearic Acid	4.00
Zinc Oxide	5.00
Mercaptobenzothiazole	0.75
Antioxidant	1.00
Sulphur	3.00
	167.25

Samples were cured in a press over a range of time at 30 pounds' steam.

T-50 readings and stress-strain curves were made on samples representing the three grades of black each day for 19 days to determine the accuracy of the test. These results are plotted in Figure 6. The T-50 results obtained on the same stock in 19 different tests show only a slight variation; the average variation is of the order of 0.4° to 0.5° C.

In Figure 7 the modulus values obtained from the same samples are plotted, and it is evident that considerable variation was obtained, although the author states this variation can be classified as within experimental error.

A comparison of these graphs would indicate that T-50 data are more sensitive than modulus data for judging state of cure. The data also indicate that T-50 data are reproducible within small limits of experimental error, i.e., 0.5°.

Roberts[7] concluded that, "The use of the T-50 test is an excellent method for evaluating the effect on rate of vulcanization of carbon gas blacks. The test has proved to be a rapid and accurate means for measuring this value from the standpoint of production control."

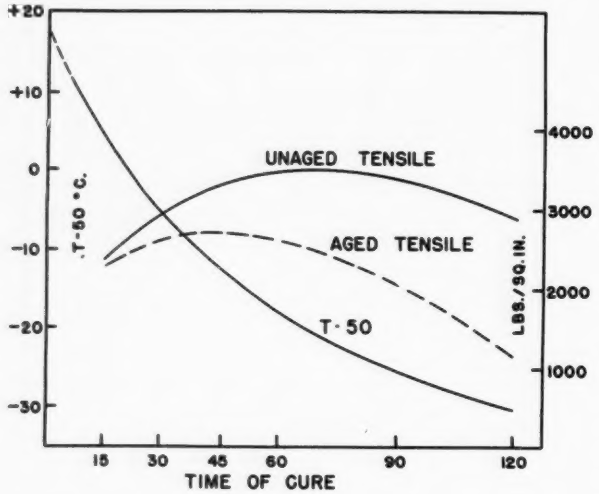


Fig. 8

T-50 in Practical Compounding

The use of the T-50 test in practical rubber compounding has been well treated by Tuley.[6] He describes a suitable apparatus and technique and then illustrates practical uses of the test for: comparing anti-scorch materials; degree of activation or retardation by antioxidants; coordination of cure; state of cure in low sulphur compounds, reclaim compounds, and latex compounds; control testing; material uniformity; and determination of reversion. The practical aspects of the test are illustrated by data from stocks representative of commercial practice.

The work of Roberts[7] in evaluating the rate of vulcanization of carbon blacks was treated in a former section and is an example of a practical application of the T-50 test.

Haslam and Klaman[8] made a thorough study of the T-50 test applied to zinc oxide compounds. In investigating the technique of performing the test, they found no difference in T-50 data if the initial temperature of the bath were –50° C. instead of –70° C. as suggested by the originators of the test.[3] They also found no difference in T-50 values of identical samples tested daily for a period of one to 14 days after vulcanization. After these fundamentals were established, the curing rates of various zinc oxides were studied, and results expressed as the minutes of cure required at a given temperature to reach a T-50 value of –7° C. It was concluded that the T-50 test was an efficient reliable method for determining the state of cure of a rubber compound. They state, however, that T-50 data did not reveal any basic information which could not be determined by conventional methods.

Utility of the T-50 Test

All the published data on the T-50 test have been examined, and the test has been compared with each of the conventional methods for judging state of cure. In determining the acceptability of a test, ease of manipulation and reproducibility of results must be considered as well as significance of the data obtained. Investigators who have reported on the T-50 test in the literature have satisfied themselves that the test is easy and quick to perform, and they have found it possible to reproduce results within narrow limits of experimental error.[7, 6, 8]

[8] "The T-50 Test Applied to Zinc Oxide Compounds." Haslam and Klaman, *Ind. Eng. Chem.* (*Anal. Ed.*), 9, 12, 553 (1937).

It would appear, then, that the T-50 test satisfies the prerequisites of ease of manipulation and reproducibility of results.

In comparison with stress-strain data for indicating state of cure, it would seem safe to conclude that the T-50 test, although probably no easier to perform, is more sensitive and consistent as shown by Roberts.[7]

Tuley[6] calls attention to the high tensile strengths often obtained on latex films even though the compound is undercured. Such data might lead one to believe that the stock was cured to its optimum, but aging nevertheless would be comparatively poor. The T-50 test presumably would detect such a defect once the optimum conditions were established.

In comparison with analyses for combined sulphur, the T-50 test obviously is much quicker and would seem to be at least as sensitive for following the rate of cure. In fact, it has been shown in the present study and by Somerville[5] that T-50 continues to decrease in overcures after combined sulphur determinations reach a constant value. This would indicate that T-50 data are more sensitive for following cure over a broader range.

For practical purposes T-50 data are of comparative rather than absolute value. A T-50 value by itself means very little unless it be referred to other physical or chemical properties of a rubber compound which vary with state of cure. As an illustration of this principle, tensile strength, aging, and T-50 data for a rubber compound are projected on Figure 8, showing how they vary with progressive states of cure.

T-50 data appear to be of most value as a reference point which ties in various properties with state of cure. Having determined for any given compound that state of cure which brings out the desired properties to their fullest extent, the T-50 value is noted and the maximum development of those properties is insured in subsequent batches by curing to the same T-50.

Generally speaking T-50 cannot be used universally to predict tensile strength or per cent. of sulphur combined with the rubber except for a specific compound where the relation has been established. One exception cited in the literature[4] is the case of compounds containing no zinc oxide where there appears to be a definite relation between T-50 and per cent. combined sulphur. This type of compound, however, is of limited commercial importance at the present time.

The observation made in a former section of this paper of the characteristic relation which results when T-50 and time of cure are plotted on log-log paper may be the basis for considering T-50 data of absolute as well as comparative value. This relation must be studied in greater detail, however, before any important conclusions can be drawn.

Conclusions

It is the consensus of opinion in the literature that the T-50 test is reliable, sensitive, and easy to perform. The present analysis of the T-50 test compared with other methods for determining state of cure indicates it to be more sensitive and consistent than stress-strain data and easier to perform than sulphur analyses. In addition it seems to be a more constant function of state of cure than combined sulphur, and detects other factors contributing to state of cure which, for convenience and lack of a true understanding of their exact nature, may be referred to collectively as "Vulcanization Potential."

Plotting the logarithm of T-50, expressed as absolute temperature, against the logarithm of the time of cure seems to hold interesting possibilities for future study.

Evaluation of Carbon Black by Rate of Cure and Extrusion

C. R. Johnson[1]

FIFTEEN years ago carbon black was delivered to the rubber industry as such with no specifications except an upper limit for grit (hard carbon) and ash. The ash specification was undoubtedly inserted as a safeguard against adulteration since carbon black rarely shows over 0.06% ash. Over the intervening years as a result of the study of the composition and nature of channel black, considerable progress has been made in evaluating carbon blacks. This progress has mainly been in the development of certain tests such as volatile matter content, accelerator adsorption tests, pH values, T-50 test, all of which reflect more or less directly the influence of a carbon black on the rate of cure of a rubber composition.

Indirectly, however, these tests point to other qualities besides effect on rate of cure. One of the important properties reflected to some degree by accelerator adsorption is average particle size, but probably only in a qualitative manner. From a theoretical standpoint, D. P. G. adsorption is dependent on two factors: (1) the amount of surface per unit weight (particle size inverse index); (2) the specific adsorptive capacity of the unit surface. It is possible to conceive of two blacks in one of which factor (2) is greater, but factor (1) is less than in the other, with the result that the first black may show a higher D. P. G. adsorption and yet have a larger average particle size. Such a black has been made, but in general a higher D. P. G. adsorption indicates a smaller particle size.

There can be little doubt that particle size influences the behavior of carbon black in both unvulcanized and vulcanized rubber mixtures, but until better methods of measurement are developed, it would be unsafe to say that particle size alone is the determining factor in the behavior of carbon blacks. At the September, 1939, meeting of the American Chemical Society in Boston two papers[2] were given which described attempts to determine average particle size. Results were reported which differed in order of magnitude so that further work would seem desirable. It would be very helpful if these studies could be continued, using identical samples. The method described by Clark and Rhodes utilizes X-Ray photographs and the system of Warren for analyzing X-Ray photographs which do not exhibit crystal patterns. The method used by Emmett and De Witt depends on a determination of specific surface, utilizing low-temperature measurements of adsorption. It requires three assumptions which may or may not be accurate: (1) spherical shape of the particle; (2) complete monomolecular layer of adsorbed substance; (3) calculated area occupied by each adsorbed molecule.

The values obtained by Clark and Rhodes did not as a whole vary enough numerically to account for quite wide differences in other properties such as D. P. G. adsorption. This raises the question whether the method is sufficiently accurate or whether variations mentioned are due to factors other than particle size.

In more recent years the processing qualities of compounds containing high loadings of carbon black have received considerable attention by producers and consumers. If the matter of road wear in tires could be dismissed from consideration, there would be little argument against use of so-called easy processing channel blacks. If equal dispersion is assumed, greater mixing capacity, lower power costs and greater tubing capacity can be realized. There is a rather strong difference of opinion among chemists and engineers of various tire companies concerning the advisability of using easy or hard processing channel blacks. Undoubtedly in most cases competition for maximum average tread wear in tires has led all companies to find the happy combination of formula, processing specification, and type of black to fit their particular needs. There can be noticed, however, a tendency toward easier processing blacks wherever production requirements demand more mixing and tubing capacity. The so-called very easy processing channel blacks (Firestone plastometer 12-16 seconds) have not met with favor among the majority of tire companies because of unfavorable tread wear.

In any event it would be unfortunate if demand centered on such grades, as they are limited in supply because a richer gas (more ethane, propane, butane) is required to make them, and comparatively little of such gas is available after the oil companies have processed for natural and polymerized blending fractions for motor fuels.

There is no established method for evaluating processing qualities of carbon blacks. Nellen[3] has developed a combination of screw extrusion and diaphragm motivated extrusion which is good. We have found the Firestone plastometer to be a satisfactory instrument for the purpose which gives good correlation with practical conditions of stock preparation. We have conducted a comparison of the Firestone plastometer (Dillon laboratory type) with the U. S. Rubber (Mooney type) under conditions where all variables are eliminated except the plastometers. This comparison showed consistent agreement, but somewhat greater scale range for the Firestone instrument for a given series of blacks. However the U. S. Rubber plastometer is entirely adequate for evaluation purposes.

Using a standardized procedure of mixing and testing with the Firestone plastometer on a 60-40 rubber, carbon black (master batch) laboratory mill mix, we have found commercial rubber blacks ranging in extrusion time from 12 to 35 seconds. Use of the master-batch formula serves to widen the scale range which otherwise would be diminished by use of a standard tread formula. Great care must be exercised to standardize all steps, and even then variation of plus or minus 6% can be expected.

Here again more precise measurements of average particle size would enable more accurate appraisal of its influence on the processing qualities of carbon black. Until that is achieved we have to assume that processing characteristics are affected by particle size as well as by the physico-chemical surface forces of the carbon black.

One well-established fact is that all 12-16-second blacks

[1] Technical director, Continental Carbon Co., 295 Madison Ave., New York, N. Y.

[2] "Practical Evaluation of Commercial Rubber Carbon Blacks by X-Ray Diffraction," by G. L. Clark and H. D. Rhodes, presented before the Division of Rubber Chemistry, A. C. S., Boston meeting, Sept. 11, 1939; "The Measurement of the Surface Areas of Porous Glass, Chabasite, Carbon Blacks, Paint Pigments, Cement, and Miscellaneous Porous and Finely Divided Materials by Low-Temperature Adsorption Isotherms," by Paul H. Emmett and Thomas De Witt, presented before the Division of Colloid Chemistry.

[3] *Ind. Eng. Chem.*, 29, 886 (1937).

which we have tested show very low accelerator adsorption.

After consideration of extensive studies of carbon blacks, based on accelerator adsorption, volatile matter, T-50, processing qualities, and stress-strain curves on vulcanized test compounds, we have found it convenient to divide our production of carbon black into seven grades which take into account processing characteristics and rate of cure. Their characteristics are set forth below:

	Volatile Matter	D. P. G. Adsorption	pH	Firestone Plastometer*	T-50†
A. Fast Cure, easy processing...	4.63%	30-38%	4.4	17-20 sec.	A — 14.5° C.
B. Fast Cure, medium processing	4.87%	30-38%	4.5	20-25 sec.	B — 15.0° C.
C. Medium Cure, easy processing...	5.14%	38-45%	3.9	17-20 sec.	C + 2.0° C.
D. Medium Cure, medium processing	5.18%	38-45%	4.0	20-25 sec.	D + 2.1° C.
E. Medium Cure, hard processing...	5.25%	38-45%	4.1	25-29 sec.	E + 2.4° C.
F. Slow Cure, medium processing	5.64%	45-50%	3.7	20-25 sec.	F + 4.2° C.
G. Slow Cure, hard processing....	5.82%	45-50%	3.8	25-29 sec.	G + 4.4° C.

*Firestone plastometer tests carbon black master batch—60 rubber—40 carbon black—1 stearic acid, diaphragm pressure 17 lbs. sq. in.—temperature of extrusion 190° F.

†T-50 test grades A, B on D. P. G. formula 60′ cure at 288° F. Grades C, D, E, F, G on Captax—formula 60′ cure at 280° F.

Figure 1 shows graphically the variations in properties of the several grades in the foregoing table with respect to D. P. G. adsorption, volatile matter, pH value, and extrusion time on the Firestone plastometer. Figure 2 illustrates the stress-strain values of Grades B and D and the time-tensile curves of Grades B, D, and F using the test formula:

Rubber	93.0
Carbon black	36.4
Zinc oxide	5.6
Stearic acid	2.0
Sulphur	5.0
D. P. G.	.7
	142.7

While it would be fair to say that considerable progress has been made in recent years in added knowledge and varieties of tests for evaluating carbon black, it must be noted that most of these tests are indirect and somewhat blind as to interpretation. What is needed is more exact knowledge of the molecular structure and the surface chemistry of carbon black.

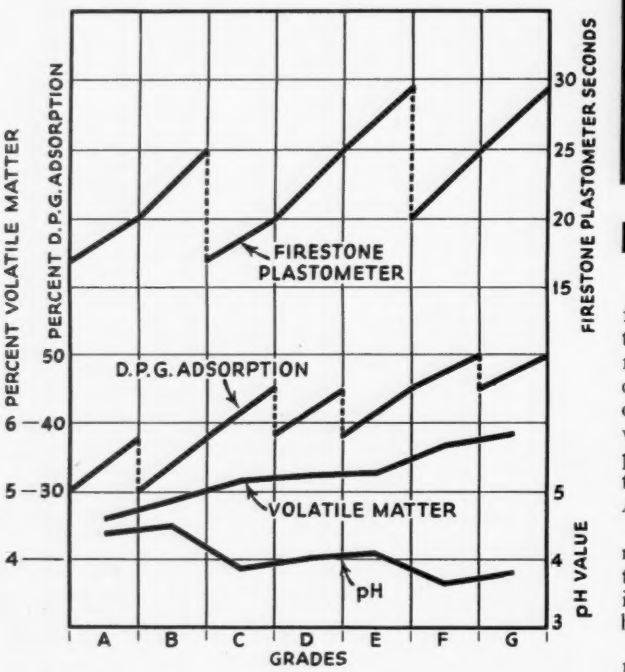


Fig. 1

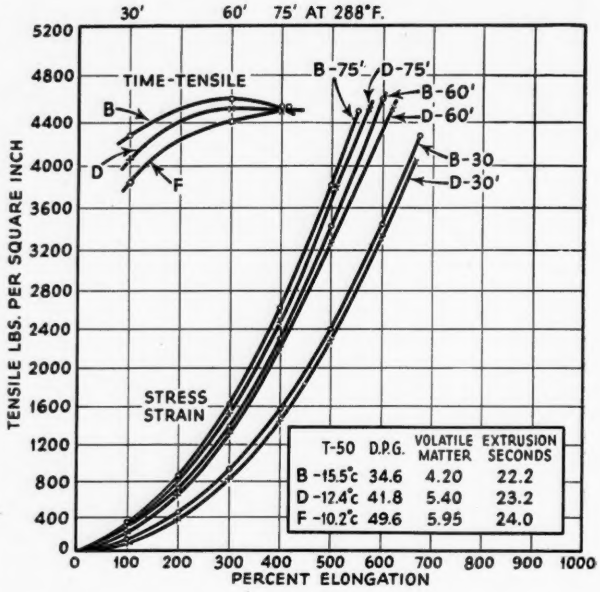
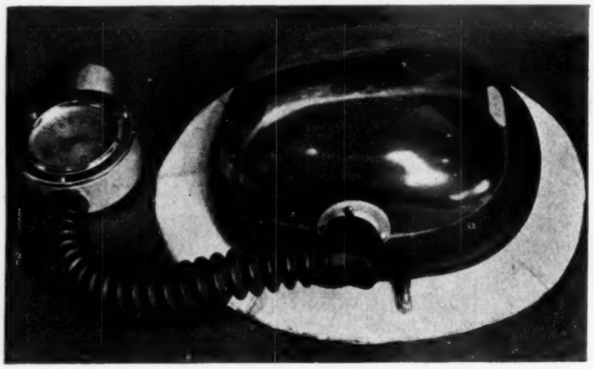


Fig. 2



Rubber-Sealed Lung

The General-Collins emergency lung, shown publicly for the first time before the American Hospital Association on September 25 to 29, is designed to induce artificial respiration in cases including infantile paralysis where chest walls have become inactive. The lung, developed by engineers of the General Tire & Rubber Co., Akron, O., will be distributed by W. E. Collins, of Boston, Mass., producer of the well-known "iron lung." Success of first tests on the new lung has recently been announced by American and Canadian medical authorities.

The lung is constructed of a transparent material, permitting vision of the patient's chest walls. A perfect seal to the patient's body is insured by a pneumatic rubber ring in conjunction with a sponge rubber flap. Air is supplied by an electric pump, operated by a ¼ h.p. motor.

Advantages over the conventional "iron lung" include low weight and low cost, and, as it covers the patient's chest only, it leaves his arms and legs free for care.

The Measurement of the Plasticity of Rubber[1]

William M. Widenor[2]

AS HOEKSTRA states, "Control of plasticity during fabrication is of great interest from a technological standpoint. From the standpoint of works economy the problem is not less urgent, because energy used by internal mixers and mixing rollers as well as extra costs resulting from wrong plasticity in calendering and molding are of importance in total production costs."[3]

For the purpose of factory control and also for experimental work numerous plastometers have been developed. Even though details of construction vary considerably, it may be said that there are three general types: (1) the compression type, in which in almost every case the sample is compressed between two parallel plates; (2) the extrusion type, where the rubber is forced out through an orifice by a screw, piston, or other means; and (3) the shearing plastometer, in which the rubber is subjected to a confining pressure and then sheared by means of a rotating disk or cylinder.

Compression-Type Plastometers

Probably the most common plastometer of the compression type is the Williams dead-weight parallel-plate plastometer.[4] The method of obtaining the plasticity of a sample of rubber by means of this instrument is as follows:[5] A spherical rubber sample of 2 c.c. vol. (diameter 1.562 cm.) is placed between two parallel plates and a load of 5 kg. is applied on it. After a time, usually three or five minutes, the thickness of the rubber is read The measure of plasticity is index K.

$$K = yx^n$$

where y is the thickness of the sample in mm. after compression, x the time in minutes, and n a constant. The value of the Williams equation has repeatedly been disputed, and therefore in many laboratories it is considered simpler and satisfactory for most purposes to take as "plasticity" the thickness of the 2 c.c. rubber pellet after three or five minutes' compression. Another figure known as "recovery" is frequently given and represents the percentage increase in thickness over the reading of the plastometer, after the sample is removed from the oven and kept at ordinary temperature for one minute. Another way of determining plasticity on the Williams plastometer is to take as the measurement of plasticity the time in minutes necessary to compress the sample from one arbitrarily determined thickness to another.

Garner found[6] that the Williams plasticity number was seriously affected by the presence of various substances on the surface of the rubber sample. For example, French chalk reduced the plasticity by almost one-half; whereas carbon blacks caused an increase in the plasticity number.

DeVries[7] modified the Williams instrument to provide a constant area of contact with the rubber.

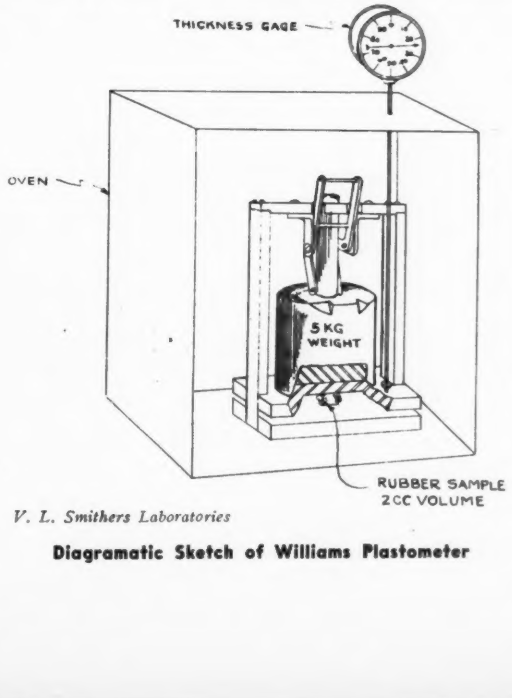
Dillon and Johnston have stated[8] that there is an inherent difficulty with any compression-type plastometer operating by gravity alone. The compression strength of the pellet increases so rapidly after reaching a y value of, say 2.0, that further deformation is extremely slow and therefore the instrument's sensitivity is greatly decreased.

It has been pointed out by Winkelmann and Croakman[9] that the Williams plastometer is less sensitive than the Goodrich instrument.

Williams has developed another parallel-plate compression plastometer using a pendulum as the source of energy to produce a definite deformation.[7] A pendulum of known potential energy, when released from a horizontal position, actuates a cam, which serves to compress the rubber between parallel plates. After the pendulum reaches the lowest point, the cam rapidly releases the upper plate in order that the elastic recovery may be followed. Duplicate determinations vary by not more than 1%.

Data obtained with the two instruments (pendulum-type and original Williams dead-weight parallel-plate plastometer) are directly comparable only in regard to the elastic recovery. The pendulum instrument shows a much higher recovery than does the dead-weight apparatus. The thickness index of the original parallel-plate plastometer has a greater percentage spread than the energy consumed by the pendulum instrument and is probably satisfactory for following the uniformity of a given material. The energy consumed should, however, be a more reliable index for a comparison of various rubber compounds or other materials. The early stages of vulcanization are detected with the pendulum plastometer by the rapid change in the elastic recovery.

In the plasticity measurement with the Goodrich instrument,[10] developed by Karrer, the time factor is constant, the force is allowed to vary within certain limits, the deformation is variable within certain limits, and other conditions are kept constant. A small cylinder of rubber



V. L. Smithers Laboratories

Diagramatic Sketch of Williams Plastometer

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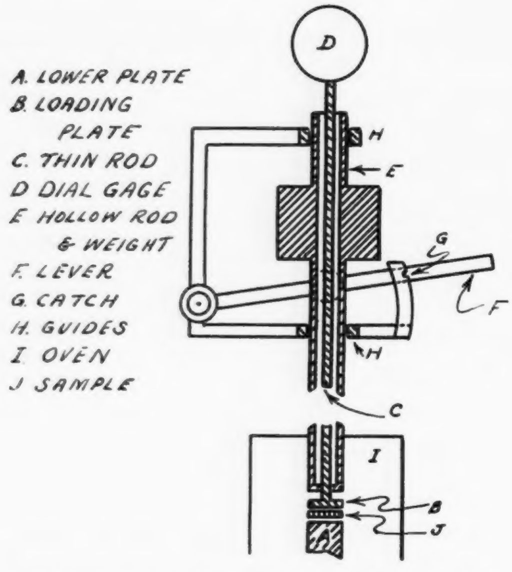
[1] Presented before the New York Group, Division of Rubber Chemistry, American Chemical Society, October 20, 1939, as winner of the second prize in the Essay Contest sponsored by the New York Group.
[2] Lee Tire & Rubber Co., Conshokocken, Pa.
[3] Hoekstra, *Rubber Chem. & Tech.*, 12, 434 (1939).
[4] Williams, *Ind. Eng. Chem.*, 16, 362 (1924).
[5] Lefcaditis, *Rubber Chem. & Tech.*, 7, 130 (1934).
[6] Garner, *Ibid.*, 3, 293 (1930).
[7] Williams, *Ibid.*, 9, 626 (1936).
[8] Dillon and Johnston, *Ibid.*, 8, 55 (1935).
[9] Dieterich and Davies, *Ibid.*, 4, 552 (1931).
[10] Karrer, *Ibid.*, 2, 592 (1929).



Sketch Illustrating Principle of Simplified Goodrich Plastometer

is placed between two jaws of the same diameter as the sample, the upper of which is movable vertically. A spring is then released which through a plunger causes the upper jaw to move downward and impart to the sample a deformation (change in height). After this deformation has been produced, the force of the spring is suddenly removed. To measure the amount of deformation that has been retained, a piston rests lightly upon the upper surface of the sample and remains in contact with it continuously, the amount of recovery being indicated on a dial. Only stocks that require more than one second for complete recovery may be studied with the Goodrich instrument.

The original instrument has been simplified for factory control use. Compression and recovery periods of 30 seconds have been adopted for the simplified Goodrich plastometer.[11] The plasticity is expressed as the product of two factors, viz., softness and retentivity.

$$\text{Softness (S)} = \frac{h_0 - h_1}{h_0 + h_1}$$

$$\text{Retentivity (R)} = \frac{h_0 - h_2}{h_0 - h_1}$$

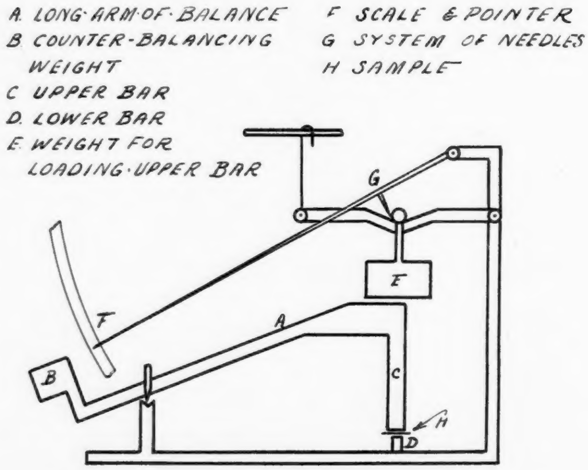
h_0 is original height of sample,
h_1 is height after 30 sec. compression,
and h_2 is height after 30 sec. recovery.

$$\text{hence, Plasticity} = \frac{h_0 - h_2}{h_0 + h_1}$$

Dieterich and Davies[3] have devised several methods for the study of scorching and other plasticity changes in rubber compounds on heating, making use of the Goodrich plastometer. The instrument has proved a powerful tool in the study of mastication, mixing, calendering, and tubing problems. In routine procedure results agreeing within 5% may be expected.

Hoekstra states that with his balance plastometer[12] it is possible to study the way in which the "yield value" or the degree of plasticity varies with the time and the percentage of compression. The principle of the instrument is as follows: A bar is fixed to the long arm of a balance with unequal arms; the vertical displacement of this bar, which rests on a specimen of the material to be investigated, is magnified 50 times and read on a scale. The specimen rests on a second bar with a known cross-section. The first-named bar can be loaded with a known weight, and this weight can be removed at will.

The pressure on the specimen is kept constant, and volume control of the specimen is eliminated. It was found that the slight non-parallel motion of the under surface of the upper bar against the upper surface of the lower bar is of no influence on the readings of the instrument compared with the readings of a true parallel-plate plastometer. The compression may be varied so that the whole range (zero to maximum compression) may be studied



Sketch Illustrating Principle of Hoekstra's Balance Plastometer

Hoekstra has also developed a so-called "short-time" plastometer.[3] This instrument was designed to follow the variation in plasticity of a rubber stock which was being worked on a factory or laboratory mill. Preforming and heating of the specimen is done between the steamheated dies of the plastometer itself. (This method of heating is also used in the Scott plastometer.) The rubber is sampled by means of a special, strong punch in the form of a pair of tongs compressing and cutting at the same time.

Essentially the short-time plastometer is composed of a pair of iron jaws with their fulcrum axis at the left end, each carrying at their right end a copper bar. Compression is effected between the flattened ends of these bars. Both jaws carry a yoke at both ends of which two springs are fastened. The two springs are stretched to the desired stress (10 kg.) by means of a screw nut. The relative displacement of the dies toward each other is magnified some 100 times by a system of needles and read on a scale.

Results agree within 2%. Comparison of the balance and short-time plastometers using many different stocks gave a smooth-curve relation. So it may be concluded that the same rheologic property of rubber stocks is measured with the two instruments. The short-time plastometer can be used to control plasticization of a rubber stock to a predetermined value. It can also be used in following "scorching" effect on laboratory rolls. A third example

[11] Karrer, Dieterich, and Davies, *Ibid.*, 3, 295 (1930).
[12] Hoekstra, *Ibid.*, 7, 136 (1934).

of the use of the instrument is the determination of the stiffening action of pigments.

Lefcaditis[5] has designed an instrument which incorporates the various modifications of the compression plastometer. The instrument consists essentially of a system of two horizontal parallel plates, one of which can be moved in a vertical direction. Some accessories are occasionally used with the instrument to reproduce the requirements of the various types of plastometer.

This "multi-form" plastometer can be used as (1) Williams plastometer, (2) Van Rossem (Delft Institute) modification (constant pressure), (3) Goodrich plastometer, (4) plunger-type dial gage, and (5) Pusey-Jones plastometer. (This is actually a hardness-elasticity tester, mostly used for vulcanized rubber. The indentation produced by a ball under a certain load is a measure of the hardness.)

Table 1 gives, in comparative form, information concerning some of the compression plastometers mentioned in the foregoing discussion.

Extrusion-Type Plastometer

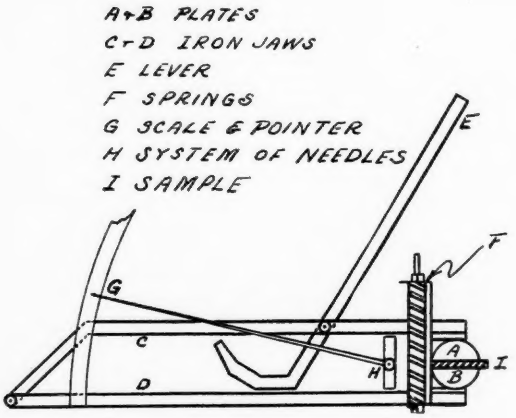
Extensive measurements of the plasticity of rubber have been carried out with extrusion-type plastometers as well as with the compression type. Dillon and Johnston have described an extrusion plastometer[13] (Firestone plastometer) operating at rates of shear comparable with those existing in rubber tubing machines (10 to 1,000 per second). The partial failure of the compression-type plastometer to correlate with the factory extrusion machine is explained on the basis of the much lower rates of shear employed in the compression-type instrument than those existing in the extrusion machine. Marzetti, Elliot and others have employed the extrusion method, but most of these experimenters have employed rates of shear differing only slightly from those of the compression-type plastometers. (See Table 2.)

Table 2. Numerical Values of Mean Rates of Shear for Various Instruments and Machines

Name of Instrument	Type of Instrument	Mean Rate of Shear	Remarks
Griffiths	Extrusion	58.5/sec.	Piston type (Size of die uncertain)
Behre	Extrusion	1.28/sec.	Air pressure type
Marzetti	Extrusion	1.38/sec.	Air pressure type
Elliot	Extrusion	0.54/sec.	Piston type
Martin	Extrusion	171/sec.	Piston type (Size of die uncertain)
Williams	Compression	0.021/sec.	After one min. compression
Goodrich	Compression	0.053/sec.	After one min. compression
Inner tube machine	....	515/sec.	$\overline{V}$ = 20 cm./sec.; slit = 0.89 mm.
Tread tubing machine	....	32.8/sec.	$\overline{V}$ = 18.5 cm./sec.; slit = 1.3 cm.
Dillon-Johnston	Extrusion	568/sec.	Piston type
Dillon	Simplified Extrusion	10.0/sec.	Piston type
Nellen	Extrusion	11.1/sec.	Air pressure 20 lb./sq. in.
	Extrusion	17.0/sec.	Air pressure 35 lb./sq. in.
	Extrusion	57.3/sec.	Worm (35 r.p.m.)
Mooney	Shearing-Disk	0.8 rad./sec.	Above and below rotor
	Shearing-Disk	1.0 rad./sec.	At side of rotor

The Dillon-Johnston extrusion plastometer consists essentially of a hardened steel piston which extrudes the rubber through a die at the lower end of a steel cylinder. This piston is operated by a pneumatic piston of larger diameter. Pressures of 605 to 9,680 lb./ sq. in. may be exerted on the rubber. The extrusion cylinder is heated electrically, the temperature being controlled to within 0.1° C. The orifice is 3.14 mm. in diameter. The test pieces are cylindrical rubber pellets which are slightly smaller in diameter than the bore of the extrusion cylinder. The preheating time is 20 minutes for all stocks. After the preheated rubber samples are transferred to the extrusion cylinder and tamped in so as to fill it completely, the occluded air is squeezed out. The extrusion

[13] Dillon and Johnston, *Ibid.*, 7, 248 (1934).

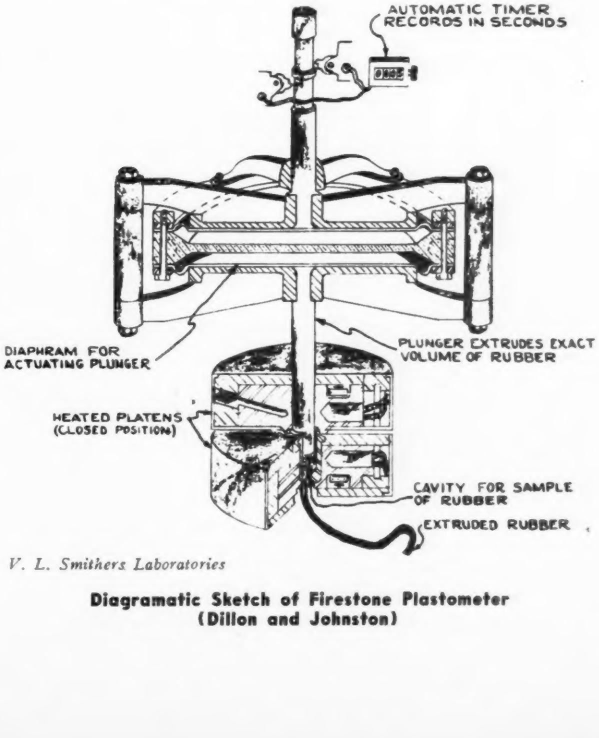


Sketch Illustrating Principle of Hoekstra's Short-Time Plastometer

Table 1. Comparative Figures on Procedures Employed with Various Parallel-Plate Plastometers

Instrument	Load	Preheating Time	Time of Compression	Temperature of Test	Initial Thickness of Sample
Hoekstra* Balance-Type	5 kg.	10 min.	Short	70° C	4 mm.
Williams (As used by Dillon†)	5 kg.	‡	5 min.	85° C. and 100° C.	Not given
Van Rossem¶ (Delft Institute)	5 kg.	Not given	10 min.	70° C.	2 mm.
Williams Pendulum Type§	**	10 min.	Few sec.	70° C.	7 mm.
Designed by Research Assn. of British Rubber Mfrs. (*a*)	5 kg.	15 min.	6-12 min.	55-90° C.	15.62 mm.
Simplified Goodrich (*b*)	Variable	20 min.	30 sec.	100° C.	11.3 mm.
Hoekstra (*c*) (Short-Time)	10 kg.	5 sec.	15 sec.	100° C.	1 mm.

* See footnote [12].
† *Rubber Chem. Tech.*, 7, 718 (1934).
‡ Entire test done inside oven.
¶ Van Rossem and Van der Meyden, *Rubber Chem. Tech.*, 1, 393 (1928).
§ See footnote [7].
**In terms of potential energy.
(*a*) Prestwich, *Rubber Chem. Tech.*, 7, 265 (1934).
(*b*) See footnote [11].
(*c*) See footnote [8].



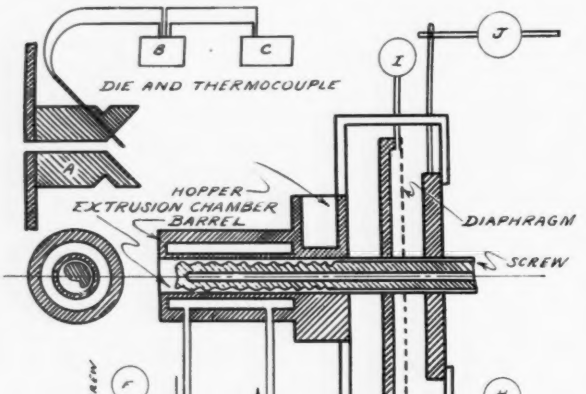
V. L. Smithers Laboratories

Diagramatic Sketch of Firestone Plastometer (Dillon and Johnston)

is then made. The length of the extruded segment before cooling gives an inverse measure of the amount of recovery. Rate of efflux is calculated as the quotient of the volume extruded and the time of extrusion. The relation between efflux rate at constant temperature and pressure, and time of milling is approximately linear.

The plastometer just described was designed primarily for use as a research instrument. The results obtained with this plastometer were found to correlate with tubing machine behavior and to agree closely with calender behavior. In many cases it was found that the extrusion plastometer results did not correlate with the Williams plastometer results and that, in general, the extrusion plastometer appeared to be much more sensitive than the Williams plastometer.

Dillon has designed a simplified extrusion plastometer[14] with the idea of fulfilling the requirements of routine control testing and at the same time obtaining test results comparable with those given by the original experimental plastometer. The diameter of the die is the same for both instruments. The simplified instrument has a steel piston which is actuated by an air piston of larger diameter. The temperature of the extrusion chamber is maintained constant to within 1° C. The sample is a folded slab which must be at least ¾-inch thick and three inches square in the folded form. The chamber of the instrument is closed by an air piston-toggle mechanism. At the end of this closing operation the chamber is completely filled with rubber, the excess having been extruded through the die. All occluded air has been forced out. The extrusion is now made, the volume extruded being 5.45 c.c. The time of extrusion, varying from two to 60 seconds, is taken as the plasticity index of the stock. An air pressure of 20 lb./sq. in. is used with soft stocks and 30 lb./sq. in. with tread stocks. The time of preheating is 24 minutes. The average total time of test is three minutes.



Sketch Showing Principal Parts of Nellen Plastometer

The selectivity of the extrusion plastometer ranges from twice to twenty times that of the Williams plastometer when the two instruments correlate. (Selectivity equals % difference between two observations on different mixtures divided by the average maximum % error.) Results of the simplified extrusion plastometer are entirely reliable in mill room control work. Dillon's extrusion plastometer shows in all cases a rapid increase of the plasticity index with increasing temperature; whereas in some cases Mooney's shearing disk plastometer shows very little change of plasticity with temperature. These and other discrepancies between the results of the two instruments may be explained in part by the fact that the extrusion plastometer operates at a much higher rate of shear than the shearing plastometer. Also, a certain amount of slippage takes place in the die of the extrusion plastometer; whereas slippage is excluded in the shearing plastometer.

Nellen[15] has described a tubing machine plastometer which has a great variety of uses. In this extrusion plastometer the temperature is regulated by means of water passing through a "barrel and worm" at 180° F. in a closed system with thermostatic control. A 2.38 mm. orifice is used for the extrusion, and built into the head of the extrusion chamber is a thermocouple around which the rubber must pass before extruding. The barrel of the tubing machine is free to move back and forth a short distance and is rigidly attached to a diaphragm operated by air pressure. Usually a pressure of 20 lb./sq. in. is used. When this is applied to the diaphragm, the barrel is pulled back with a force of 1,380 pounds.

When the instrument is used as a tubing machine, a certain amount of rubber (200 g. for crude rubber, and 250 g. for compounded stocks) is fed into the hopper at a uniform rate so as to bring both the die and the rubber in the machine to a constant temperature. Then three one-minute samples are cut off by means of a cutter fastened in front of the die. The samples are weighed individually, and the average extrusion per minute (Gx) is found. As the last sample is cut, the worm is stopped with the machine loaded and held for exactly three minutes. Then the air pressure is applied to the diaphragm, and the number of minutes required to force out 5.4 c.c. of rubber is recorded as M. The factor Gx is a direct measure of tubeability or tubing speed, and M is an inverse measure of plastic flow. Gx/M is recorded as index I. Uusually the chamber is cleaned out after every test, 15 - 20 minutes being required for each determination. If a number of samples of the same stock are to be tested, it is not necessary to clean out the chamber after each test. Enough rubber from the new sample is fed into the hopper to insure the complete removal of the rubber remaining from the previous test before the one-minute samples are taken. In this way the average time of test is reduced to ten minutes. If Gx alone is to be obtained on a number of samples of the same stock, the average time of test is about five minutes. A saving of time can also be effected by making use of the temperature indicator connected to the thermocouple built into the head of the extrusion chamber. From previous determinations the average temperature of the stock during test is known. Thus if that temperature is reached when, let us say, only 150 g. of stock have been fed into the hopper, the one minute samples may be taken without feeding in the other 100 grams. The method of test may be varied in other ways as well. The temperature of the

[14] Dillon, *Ibid.*, 9, 496 (1936).
[15] Nellen, *Ibid.*, 10, 801 (1937).

circulating water, the speed of the worm, and the air pressure, all may be varied. The volume of rubber extruded in the so-called "squeeze" test need not necessarily be 5.4 c.c., but this has been found to be convenient. By means of a solenoid arrangement ten second samples may be taken, the cutter operating automatically. This may be done, of course, either while the rubber is being extruded by means of the screw or while it is being forced out by air pressure.

The tubing machine plastometer has been used with considerable success in the following ways in the laboratory of Lee Tire & Rubber Co.

Although the length of time required for one test prevents the use of the instrument in testing all or any great number of the batches mixed in the factory, the plastometer is valuable in testing any particular stock which is not up to specifications, or in following a certain tread, tube, or carcass stock to obtain the range of plasticity caused by changes in the weather, variation in the work of a mill-hand, etc., over a period of days, weeks, or months.

Every lot of crude rubber received is tested by means of the plastometer. A standard rubber is also tested at the same time. The results of these tests are useful, e.g., in determining whether or not a certain lot of crude rubber is suitable for use in a tread stock. The instrument is valuable in following the plasticizing of rubber and in comparing the plasticities of plasticized and mill-massed rubber. In fact, the instrument may be used as a laboratory plasticating machine.

The plastometer, being also a tubing machine, can be used to determine how a particular tread or tube stock will extrude in the factory. Carbon black in master-batch form can also be tested for tubeability. The "squeeze" test gives some idea of how the rubber being tested will act in the mold.

The instrument is valuable in testing pine tar substitutes, stiffeners, etc., and in the development of stocks of certain desired characteristics. It is possible to determine by its use whether or not a stock is set up. The extent of scorching can also be ascertained. Any kind of unvulcanized rubber, even sponge stock, can be tested by means of this instrument.

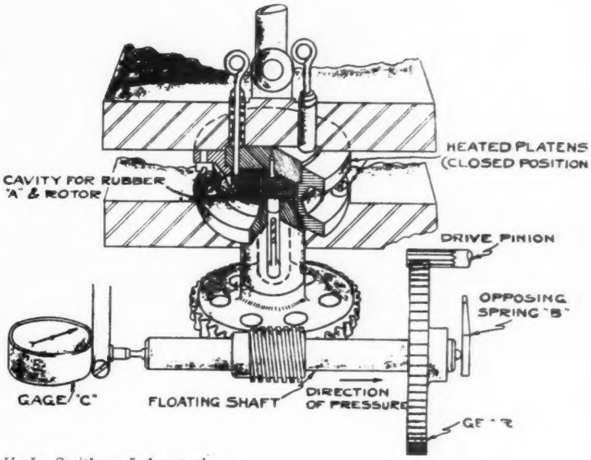
The plasticity figures obtained in practically all cases are large enough so that small differences in plasticity may easily be noted. This instrument will show differences in plasticity where the Williams and other compression plastometers show no difference at all.

It is possible to obtain a good average value of the plasticity of a batch of non-uniform stock by making a composite sample out of smaller samples from various parts of the batch. Similarly the average value of plasticity for several batches can be obtained from one test.

Some of the results obtained with the Nellen plastometer have been published. The value of R.P.A. as a rubber softener[16] has been studied, as has the effect of pigment particle size and surface on the processing characteristics of rubber compounds.[17] The use of the tubing machine plastometer in determining variations in softness of rubber resulting from differences in roll temperatures and mill roll setting has also been set forth in a paper.[15]

Gx and M have a direct relation when the same type of rubber or compound is compared, but not always when different types of rubber or different compounds are compared. Although the Gx/M figure may mean little mathematically, it is a good index of the actual softness of the stock. If stocks are graded arbitrarily by "feel" on the mill, they fall into line with the Gx/M figure more closely than with either Gx or M.

[16] Nellen, *Ind. Eng. Chem.*, 29, 886 (1937).
[17] Nellen and Barnett, *Ibid.*, 30, 776 (1938).
[18] Mooney, *Rubber Chem. & Tech.*, 7, 564 (1934)



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Diagramatic Sketch of Mooney Plastometer

Shearing-Type Plastometers

The third and last type of plastometer is the shearing type. Mooney[18] has designed two instruments of this variety. In one, the test material is contained between a pair of concentric cylinders in relative motion. This instrument is used primarily for research work. The other instrument is essentially the disk form. The latter is used for general plasticity work both in laboratory and factory and is the one which will be discussed here.

The roughened surfaces between which the rubber is sheared consist of the disk-shaped rotor, and the upper and lower halves of the stator. The two halves of the stator have the shape of shallow circular cups and, when held with their brims in contact, form together a closed cylindrical chamber. The rotor is held vertically centered in the stator chamber. The device for maintaining pressure on the rubber consists of a pair of plungers forced downward by springs. The rotor is connected through a vertical spindle, worm gear, and horizontal shaft to a synchronous A.C. motor. No oven is necessary. Two platens, which are in contact with the stator and certain other parts of the instrument, are heated by means of steam or electricity. Measurements are carried out at 100° C. The gage reading obtained is proportional to the viscosity of the rubber and is called its "shearing viscosity." The usual time required for one determination is three minutes, but with certain samples, particularly unbroken rubber or cold tread stock not recently milled, three to five minutes may be required.

The major advantage of the shearing disk plastometer is its speed. Another advantage is that batches of rubber which are not homogeneous can be tested and an average viscosity obtained. In accuracy or sensitivity the shearing plastometer compares favorably with the Williams form of the compression plastometer. The shearing plastometer has the ability to work air out of the sample. Another result of continuously working the sample during the measurement is that the sample is measured in its more plastic state, as opposed to the harder condition that it attains when allowed to rest. The shearing plastometer gives results which in general do not differ in their indications from those obtained with the Williams plastometer.

Table 2 gives the numerical values of mean rates of

shear for various instruments and machines. It is readily seen that the only plastometers which have mean rates of shear comparable with those of processing machines are of the extrusion type. The figures above the dotted line are from the table given by Dillon and Johnston.[13] Those below the dotted line were computed by the writer. The formula for a circular orifice, given by Dillon and Johnston[13] was used in calculating the mean rate of shear for the Dillon and the Nellen plastometers, and, of course, Mooney's formulae[18] were used in calculating the figures given for his instrument.

Theories of Plasticity and Its Measurement

There are a number of ideas and opinions as to what plasticity is and how it should be measured.

Karrer[10] states that the role which plasticity plays may be overshadowed by and confused with the interplay of elastic and hardness phenomena on one hand and permanent set and viscous flow on the other. He offers a general definition of plasticity. In his own words: "Plasticity is the susceptibility to and the retentivity of deformation." The first aspect of plasticity refers to softness, the second to permanent set.

Dillon and Johnston[13] mention mobility and yield stress as two quantities necessary to define the plastic state of a material. They also say[8] that the only reliable criteria of plastic flow by means of which the flow conditions of a testing instrument or machine can be compared are the rate of shear and the shearing stress.

According to Dillon,[19] the plastic state of a finished rubber stock is determined mainly by three factors: initial plastic state of the crude rubber, nature and amount of mechanical treatment given the rubber, and amount of premature vulcanization (set-up) introduced during processing.

Karrer[10] has pointed out the need of controlling the time factor during compression and recovery. Dillon[19] evaluates recovery measurement as not only a measure of the residual elasticity of the rubber, but also of the plastic properties. He states that elastic recovery is dependent upon speed of deformation of the rubber (rate of shear). Williams[7] observes that the consistency of rubber can be determined equally well by measuring either the resistance to flow or the recovery, provided that only one grade of rubber is considered. When different types of compounded or uncompounded rubber are considered, the relation between resistance to flow and elastic strain does not remain constant. For this reason he states it is necessary to determine both resistance to flow and elastic recovery in each case, the latter being measured only after shear sufficient to produce an equilibrium stress. Hoekstra[3] has concluded that elastic recovery should be measured only after compression of a rubber to a fixed thickness. He also states[12] that because of the "overlapping of the elastic and plastic stages" (as mentioned by Peek), the question of the recovery of masticated rubber and related substances is as yet rather unsolved and that Karrer's method of expressing plasticity (softness) and recovery in one figure is not to be regarded as a solution of the problem.

Mooney[18] believes that plasticity measurements should be carried out under conditions of thixotropic equilibrium. (Thixotropy is the property of softening while being worked, and hardening again while standing.)

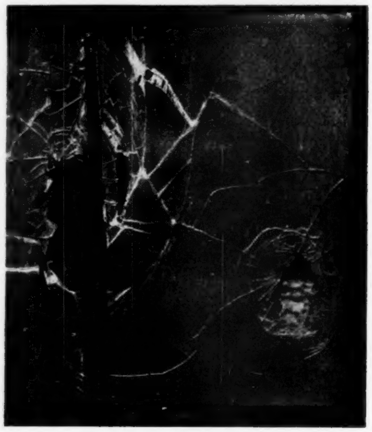
DeVisser[20] is of the opinion that the change in shape of a compressed piece of unvulcanized rubber is permanent if the compression is carried out above 70° C. This has been borne out in compression and recovery tests on first latex crepe by Van Rossem and Van der Meyden.[21]

Nellen[15] states that rubber becomes softer when milled on a cold mill than when milled for the same length of time on a hot mill. However Behre[22] believes that mastication of rubber should take place on hot rolls in order that the "nerve" may not be destroyed. His plasticity measurements are made at the temperature of mastication. By this method he maintains rubber masticated on hot rolls will show a higher plasticity than that masticated on cold rolls for the same length of time. This is contrary to the results of Dillon and Johnston.[13] Behre states that if one sample of crude rubber is masticated on cold rolls and another on hot rolls and then both products are tested at the same temperature, e.g., 100° C., by means of an extrusion plastometer, the "nerve" is a decisive factor in the rate of outflow, i.e., the greater the extent to which the nerve is destroyed, the greater is the outflow.

In conclusion it may be stated that the measurement of plasticity is very useful both in factory control and in experimental work. In factory control, speed and duplication of conditions existing in processing machines are important. Empirical measurements are quite satisfactory. On the other hand it may be desirable, in the experimental laboratory, to measure precisely a fundamental physical property of rubber. Here it may be necessary to consider conversion factors in order to obtain absolute values of plasticity. Speed is not such an all-important factor in research work as in control work. The nature of the work, i.e., routine or experimental, is the determining factor in the selection of a suitable plastometer.

[19] See footnote †, Table 1.
[20] See Footnote (a), Table 1.
[21] See footnote ¶, Table 1.
[22] Behre, *Rubber Chem. & Tech.*, 8, 266 (1935).

Latex Protects Glass Windows



Universal Trade Press Syndicate

Among many British safeguards, such as wire screen, cellulose sheets, and criss-cross gummed paper strips, against the shattering and splintering of glass windows subject to percussion is the use of latex sprayed or painted on the glass. Single sprayed coats of latex averaging 0.004- to 0.005-inch in thickness on ⅛-inch glass windows were found to prevent splintering when a two-pound spherical weight was dropped on the protected glass from a distance of six feet; whereas unprotected glass shattered in all directions under the same force. The accompanying photograph illustrates a window against which bricks had been flung after a commercial latex film has been brush painted on the glass. No dangerous, flying splinters of glass entered the room.

T-50 Test As a Control for Inner Tubes[1]

William B. Dunlap, Jr.[2]

SINCE its development a few years ago the T-50 test has become widely used as a convenient and relatively quick measure of the rate of cure. To date, however, there has been very little information published on one very important use of this test: its use as a processing control.

The object of this paper is to examine some of the problems which occurred when this test was applied to one particular phase of processing control.

In establishing the T-50 test as a factory control on the daily production of inner tubes, certain limitations were observed which had to be taken into consideration. In a previous publication[3] it was stated that differences in method of vulcanization might cause a slightly different relation between T-50 and combined sulphur than is normally found.

Comparison of Factory and Laboratory Cures

A comparison between factory produced tubes and laboratory press cures made from the same stock and given the same cure has proved the above premise to be true. In each case the stock for the laboratory press cures was cut from the tubed stock immediately adjacent to the tube to which it was compared. This stock was then cured without remilling, and the cure was made at approximately the same time as the tube in order to eliminate differences in the aging of the stock. The following precautions were taken to insure uniformity of results. The press was brought to the correct temperature, with the platens closed, at least ten minutes before the cure was made. The press was opened only far enough to insert the frame, thus eliminating preheating during the time normally taken for the press to close. The cure was timed exactly five minutes from the closing of the press to the releasing of the pressure. All cures referred to in this paper were five minutes at 305° F. except in the case of truck tubes which were cured eight minutes at 305° F.

T-50 tests were made in the following manner: A 1½-inch die was used for all test pieces; the test pieces were racked and stretched at a uniform, slow speed. After stretching, the test pieces were conditioned for five minutes at room temperature. The rack was then inserted into the testing Dewar, and the test pieces were frozen for one minute before the clamp was released. The acetone in the Dewar was gradually heated, and the T-50 temperature was taken when the test piece had retracted to 50% of the elongation at which it was frozen. T-50 tests were made on four samples of stock, and these tests were repeated daily to insure against any variation in the T-50 test. These results were practically constant. Duplicate tests were run on all stocks.

A number of tests were made, observing all the precautions mentioned, and it was found that in each case there was a difference in the T-50 value between the factory cure and the laboratory cure, ranging from a minimum of 1.2° to a maximum of 4.9°. The factory tubes, throughout, gave lower T-50 values, or to clarify this statement, appeared to have a faster rate of cure. In conjunction with this, a batch of factory stock was followed through the regular factory processing. This batch was tested for T-50 immediately after mixing, after each step in the processing, and a final test was made on the cured tube. A variation of 4.6° was found between the stock after mixing and the cured tube. A difference of 7.2° was noted between the tubed stock, cured in the laboratory, and the tube itself.

H.D. Passenger	Factory Cure	Lab. Press Cure
1	—6.7°	—4.0°
2	—3.1	—0.9
3	+0.2	+1.9
4	—5.1	—0.5
Truck		
5	0	+4.9
6	+2.9	+5.2
7	+2.0	+5.9

Factory Processing

	T-50
After Mixing	—0.5
After Warm-up Mill	+2.1
After Refining Calender	+1.5
After Knife Mill (Tuber Feed)	+1.7
After Tuber	+2.1
Cured Tube	—5.1

Since in every case the tube seemed to have more cure than the laboratory slab, the combined sulphur was determined on each. The combined sulphurs were, in all cases, practically identical for each cure. In a brief analysis of both types of cure it is found that the stock in the press cure is cured under compression with heat passing in from each surface. The inner tube is cured under a definite tension as well as compression against the mold caused by the internal air pressure with the heat applied to one surface only. It is therefore concluded that this variation in T-50 value is due to the difference in curing conditions and is entirely physical in its nature.

	Factory Cure		Lab. Press Cure	
	T-50	Comb. Sul.	T-50	Comb. Sul.
1	+0.3°	1.19%	+4.2°	1.15%
2	—1.2	1.23	+0.4	1.23
3	+0.8	1.22	+2.0	1.23
4	+7.6	1.03	+10.3	1.08
5	+3.9	1.23	+5.9	1.22

Uniformity of Cure and Effect of Grain

In large-size truck tubes of considerable wall thickness, 0.150 inch and over, curling was occasionally noticed, and the degree of uniformity of cure was considered. A section of tube wall, about 0.150 inch, was split into two pieces, each about 0.075 inch in thickness. The one half, adjacent to the mold, was called the outside, and the other the inside. T-50 specimens were cut from these two pieces, and a representative specimen was cut through the entire thickness. The inside half of the wall was slightly less than 1° lower than the outside half, and the specimen representing the entire thickness approached the value of the inside half rather than the average value.

To verify this, a section of another tube of the same thickness was split into three pieces, each about 0.050 inch and labeled outside, middle, and inside. A specimen of the entire wall thickness also was run with these pieces. The results of this test were of the same order as the previous test. The probable explanation for the inside of the wall having the most cure is that after the tube is removed from the mold, the outside cools rapidly, while the inside remains nearly at curing temperature for sev-

[1] Presented before the New York Group, Division of Rubber Chemistry, American Chemical Society, October 20, 1939, as winner of the third prize in the Essay Contest sponsored by the New York Group.
[2] Lee Tire & Rubber Co., Conshohocken, Pa.
[3] Wm. F. Tuley, INDIA RUBBER WORLD, Oct. 1, 1937, pp. 39-42.

eral minutes. This indicates that in a sample where there is a difference in cure between the two surfaces, the T-50 value of the specimen will approach the lowest value found in any section of the sample rather than the average value of the whole specimen.

As it was desired to use test pieces with gages of from 0.080-inch to 0.100-inch for the T-50 test, it was found that buffing the outside surface gave the best results. The T-50 value obtained in this manner would most closely approximate the true T-50 value, and the tendency of the test piece to curl would be reduced.

Entire Wall Thickness	Outside	Middle	Inside
+2.2°	+2.9°	....	+2.0°
+3.0°	+3.7°	+3.5°	+2.8°

Since a tuber and a mill both impart a definite graining in a stock, the effect of direction of specimen with respect to direction of grain was investigated. Specimens were cut longitudinally with the grain and transversely across the grain on both a laboratory slab and an inner tube. No significant difference was found in either the tube or the laboratory slab.

	With Grain	Across Grain
Lab. Slab	+4.9°	+5.0°
Inner Tube	+3.0°	+3.2°

Effect of Reworking the Stock on T-50 and Combined Sulphur

The T-50 tests that were made on the batch which was followed through the regular factory processing indicated that reworking the stock reduced the rate of cure. The T-50 value was 2.6° higher, a change of from -0.5° to +2.1°, when the stock was warmed up in preparation for tubing.

A study of this condition was made on a standard laboratory mill, equipped with a hot water system for controlling roll temperature.

A small piece of stock was placed in the press and cured without remilling. The T-50 value and combined sulphur content of this slab were used as a control for this series. All other tests in this series were made from this same batch of stock.

A large piece of stock was placed on the mill and sheeted out after milling 1½ minutes at 160° F. A slab was cut out, the stock placed on the mill, remilled for four minutes, and cooled ½ hour at room temperature. This four-minute remilling procedure was repeated twice, with cooling each time and subsequent remilling for 10 minutes. This stock was sheeted out again for 1½ minutes at 160° F. after aging for 24 hours. Slabs were cut out after each remilling.

		T-50	Comb. Sul.
	Squash cure (not milled)	—3.3°	1.44%
1	Stock sheeted out 1½ min. @ 160° F.	—3.1	1.41
2	Stock remilled 4 min. and cooled ½ hour	+2.1	1.03
3	Stock remilled 4 min. and cooled ½ hour	+3.8	1.05
4	Stock remilled 4 min. and cooled ½ hour	+4.0	1.03
5	Stock remilled 10 min. and cooled ½ hour	+4.0	0.94
6	Stock remilled 1½ min. @ 160° F. after 24 hours.	+0.8	1.19

Three fresh pieces of stock were taken; one was milled for ten minutes with the roll temperature at 160° F.; a second piece was sheeted out after four minutes' milling on a cold mill at 110° F.; and the third was sheeted out after milling for one minute on a hot mill at 220° F. The length of milling time on these last two samples was the time necessary for the stock to become smooth on the rolls.

		T-50	Comb. Sul.
a	Stock milled 10 min.—mill @ 160° F.	—2.2	1.33
b	Stock sheeted out—cold mill @ 110° F.—4 min.	—3.0	1.41
c	Stock sheeted out—hot mill @ 220° F.—1 min.	0	1.25

In the first series, sheeting out the stock after 1½ minutes at 160° F. had no appreciable effect on the T-50 and combined sulphur. Each successive remilling, however, showed a definite retarding of the rate of cure, and this retarding approached a constant value after the second successive reworking. There was also a noticeable regain in rate of cure after the stock had aged 24 hours.

In the second series the stock milled for 10 minutes at 160° F. showed a slight retarding of the rate of cure. The stock sheeted out on a cold mill showed very little difference from the control; while that which was sheeted out on a hot mill showed a definite retarding of the cure.

Conclusions

It is finally concluded that, owing to the difference in curing method, T-50 tests made on a cured tube and on a laboratory press cure of the same length of time and at the same temperature cannot be correlated. Therefore it is advisable for accurate results to establish the T-50 control on the cured tube.

That in cases where there is a difference in rate of cure between the two surfaces of a stock, the T-50 value of the specimen will approach the value of the part of the stock having the fastest rate of cure rather than the average value.

That buffing the outside surface of thick wall truck tubes reduces the tendency of the test piece to curl.

That the direction of the test piece with respect to the grain has little or no effect on the T-50 value.

That reworking the stock definitely retards the rate of cure, and this retarding effect increases rapidly with short periods of reworking to an approximately constant value as measured by the T-50.

Overinflation in Truck Tires[1]

During the past several years there has been a gradual swing from high-pressure truck tires to balloons. Many truck owners, however, are not receiving full benefit from their balloon equipment because they are continuing to use air pressures more in keeping with high-pressure inflation recommendations and not the pressures recommended for balloon tires.

Overinflation reduces deflection and contact area, causing the tire to ride on the crown. This results in the following: (1) tread wear more rapid than normal; (2) increased tendency toward bruise or crown breaks; (3) excessive strain on beads and rim; (4) abnormal growth and possible tread cracking; (5) more cuts and snags than would be experienced with proper inflation; (6) abnormal stresses and strains in the tread area which increase the tendency toward tread separation; (7) harder riding and increased up-keep on equipment; (8) reduced non-skid qualities by reason of smaller area of road contact.

Among the recommendations for proper inflation are: inflate to proper pressure when tires are cool; if tires are continually *under-loaded*, use air pressure to correspond with actual load carried (refer to a load and inflation table); if both load and speed are factors, either load or speed must be reduced to obtain normal service; never "bleed" tires to relieve "build up" of pressure caused by heat. The ratio of temperature to pressure "build up" in service is approximately 8½ degrees of temperature for every pound of "build up."

[1] Abstracted from Service Bulletin No. 13, Rubber Manufacturers Association, Inc., 444 Madison Ave., New York, N. Y.

EDITORIALS

War's Effect on Industry

BECAUSE of the great destruction of material things, including the products of the rubber industry, during the course of a war there must be one or both of two immediate non-escapable results, an extreme increase in demand and production or a lamentable deprivation of the things to which the people have become accustomed. The probable result is a total increase with a scarcity in at least some of the normally consumed items because of a rapid shifting to the production of the necessities of warfare. The degree of this disruption of normal activities is dependent upon many conditions, but primarily upon the extent and duration of the war. A very disconcerting factor in business during that period is the element of uncertainty which renders impossible the formulation of definite plans for the future.

Because of this commercial increase, which falls heavily on industry, the first thought might be, and in fact it has often been said, that industry benefits greatly from war. However a thorough consideration of both the current hazards to business and the events that follow show that on the average the net result is a loss. The orientation of a going concern, with a stable business to new products or even to the same type of product with new specifications, is expensive. The procurement and installation of new equipment, the development of skill by the operators on new work, and the transition from a steady normal rate of operation to a highly accelerated schedule result in an immediate operating loss which can only be overcome after the new scale of operations has reached a smoothly working status. According to past experience, after the war has ended, a period of reverse adjustment in the scale of operation is followed by one of major depression. This readjustment likewise is costly to the company. Finally, but of even greater importance, comes the period of taxation during which payment must be made for the destruction which has gone before, and as industry is the medium through which a great portion of these taxes must be collected, its business is not permitted to assume a normal well-balanced status for many years.

At the present time the financial condition of industry in general and of the government is constricted. The government is badly in debt, potential taxation media through a complex system have been practically exhausted, and the surpluses of individual companies, built up during more prosperous times, have been depleted. The per capita Federal debt is estimated at $308 in contrast to $139 in 1929. According to figures recently quoted, in the five years following 1929 manufacturers paid out nine billion dollars in addition to their net income, an act made possible by previously accumulated surplus accounts.

When all of these cold facts are taken into consideration, it is readily understandable that responsible heads of industrial companies and business organizations are adverse to war and are counseling that every possible means be taken to avert such a catastrophe in this country.

If the European war continues for a long period and if the United States does not become a party to it—and they can stay out if the will of the people remains strong—there is certain to be some appreciable increase in American business and therefore an opportunity to strengthen legitimately the financial position of individual business organizations and the government in preparation for the reaction that will follow. During this period economy should be the watchword, and taxation methods should be simplified to reduce overhead expense. Business should resist any tendency toward an unwarranted boom, and government should make it possible for business to prepare its financial structure to offset the effects of war.

The Crude Rubber Situation

THAT the International Rubber Regulation Committee, which apparently is to continue its control of rubber, is watching the supply closely is evident from the succession of quota changes during recent months. Third quarter permissible shipments were increased from 50 to 55% of basic quota on May 16 and to 60% on July 25. Fourth quarter releases were raised to 70% on September 9 and again on October 3 to 75%, or a one-half increase over and above the 50% of basic quota in effect for the second quarter.

United States consumption for July was 43,880 long tons, August 50,481, and September 50,150 for a total of 144,511 tons, compared with 135,802 tons in the second quarter, an increase of 6.4%. During the third quarter United States stocks, including stocks afloat, dropped from 233,068 to 218,481 tons, or 6.6%. Reexports in September are estimated at 3,200 tons, or eight times the previous monthly average of approximately 400 tons.

A comparison of the net changes during the third quarter of permissibles at plus 20%, U. S. consumption at plus 6.4%, and U. S. stocks including afloat at minus 6.6% indicates that the United States did not obtain its full proportion of the available rubber.

World absorption outside of the United States was for May 44,018, June 42,825, July 42,467, and August 44,391 tons, or a monthly average of 43,425. For the fourth quarter the total rubber available to the world is estimated to be 102,886 tons. After deducting 44,391 tons, the August absorption outside of this country, the balance of 58,495 tons appears ample for the United States, but if the barter agreement with its required 14,000 tons monthly is instituted or if world absorption increases, it will be necessary again to increase the quota.

S. C. Stillwagon

What the Rubber Chemists Are Doing

Prize Papers Presented before New York Group

THE three papers which won cash awards in the essay contest conducted by the New York Group, Rubber Division, A.C.S., were presented at its meeting on October 20 at the club rooms of the Building Trades Employers' Association, 2 Park Ave., New York, N. Y. The technical session was held shortly after 4 p.m., followed at 6:30 p.m. by dinner, served to 143 members and guests.

At the technical session A. H. Nellen, group chairman, thanked those who had contributed toward making the essay contest a success and then turned the meeting over to S. C. Stillwagon, chairman of the essay contest committee. After commenting briefly on the work of the committee, Mr. Stillwagon introduced in turn the three contest winners who presented their prize-winning papers before the group. The winners and the subjects of their papers were: first prize, $50, G. R. Vila, Naugatuck Chemical Division of United States Rubber Co., "A Critical Analysis of the T-50 Test for State of Vulcanization;" second prize, $40 W. Widenor, Lee Tire & Rubber Co., "The Measurement of the Plasticity of Rubber;" third prize, $30, W. B. Dunlap, Jr., Lee Tire & Rubber Co., "T-50 Test as a Control for Inner Tubes." These papers are presented in full elsewhere in this issue.[1]

Chairman Nellen then entertained a resolution read by I. Drogin recommending that the executive committee of 1940 give consideration to the idea of conducting a prize essay contest for 1940, following the general plan used in 1939. The resolution was unanimously adopted by the group.

A committee to nominate officers for 1940 was appointed by Mr. Nellen as follows: R. D. Gartrell, chairman, J. Miscall, and C. A. Bartle. This committee is to report at the next meeting, the Christmas party on December 15.

E. B. Curtis, elected chairman of the Rubber Division at the Boston meeting in September, was asked to make a few remarks to the group. Entertainment was furnished by an accordion player and by Paxton, the memory expert, who astounded those present by demonstrating his uncanny ability to recall quickly and accurately a vast amount of complicated data.

[1] Pages 34-38, 41-46, 47-48.

Chicago Group's Next Meeting

THE Chicago Group, Rubber Division, A.C.S., will meet at the Hotel Sherman, Chicago, Ill., on November 10. H. F. Weber, sales manager, Link-Belt Co., Chicago, will speak on "New Power Drives for the Rubber Factory."

Los Angeles Group Holds "Navy Night"

IT WAS "navy night" at the first fall meeting of the Los Angeles Group, Rubber Division, A.C.S., on October 3 at the Mayfair Hotel, Los Angeles, with 78 members and guests attending.

Following the business session, Garvin Drew, group president, turned the meeting over to Lt. Commander J. R. McKinney, of the United States Navy, who gave a brief review of naval history and commented on current activities to expand our navy in personnel, ships, and planes. C. J. Farrel, chief turret captain, and H. A. Breen, chief electrician's mate, assisted Lt. Commander McKinney in showing three motion pictures covering navy activities: (1) "Navy Wings of Gold," depicting aviation training at the Naval Air Station, Pensacola, Fla.; (2) "Service in Submarines," showing the submarine training school at New London, Conn., and the use of the escape lung in this type of service; and (3) "Crossroads of the Pacific," portraying shipboard life and activities in the Pacific.

The door prize, a portable radio donated by W. C. Hardesty Co., was won by R. E. Behrman, United States Rubber Co.; while a special prize, a Toastmaster set presented by the American Turpentine & Tar Co., was won by F. Baglin, West American Rubber Co. In place of the customary table favors, four additional prizes, each comprising six golf balls, were offered by H. Muehlstein & Co. The recipients of these were: W. V. Michalak, Kirkhill Rubber Co.; J. E. Tufft, *Rubber Age*; W. C. Holmes, Dill Mfg. Co.; and W. J. Haney, Kirkhill Rubber Co.

The program committee announced that a motion picture by the Underwriters Laboratories, Inc., would be shown at the meeting on November 7.

Akron Group Meets November 3

"INSIDE the Flame," Godfrey L. Cabot, Inc.'s sound film on carbon black, will be shown at the fall meeting of the Akron Group, Rubber Division, A.C.S., to be held November 3 at the Akron City Club, Akron, O. Another feature on the program is a talk by Clair A. Dietrich, who will tell of his experiences with Admiral Byrd at the North and South poles.

Canadian Rubber Section

THE Rubber Section, Canadian Chemical Association, was scheduled to meet on October 24 at McMaster University, Hamilton, Ont., Canada, with W. U. Shaw, of the National Steel Car Corp., Ltd., speaking on "Aircraft Manufacture, Past and Present."

A.S.M.E. Meetings

THE sixtieth annual meeting of The American Society of Mechanical Engineers will be held in Philadelphia, Pa., December 4 to 8 at the Bellevue-Stratford Hotel. Present plans call for 35 technical sessions at which 105 papers will be presented. Three papers on rubber and plastics will be presented the afternoon of December 6: "Physical Permanence of Plastics," by J. Delmonte; "Neoprene as a Spring Material," by F. Yerzley; and "The Importance of the Service Temperature Flow Characteristics of Thermoplastics," by W. F. Bartoe.

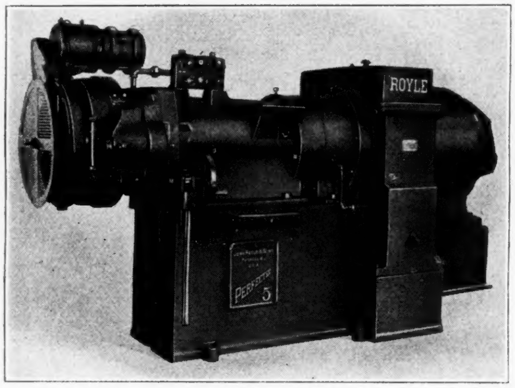
An outline of a proposed informative booklet on rubber and plastics was discussed by representatives of the Plastics and Rubber Division of A.S.M.E. at the Westchester Country Club on October 3 following the regular meeting of the Society of the Plastics Industry. The publication, which is intended primarily for engineers desiring to use the materials and for students in engineering schools, will be divided into two sections: one on Rubber and one on Plastics. Detailed discussion was conducted on the Plastics outline which covers four subdivisions: namely, Materials, Molding and Finishing, Applications, and Properties and Testing. A corresponding outline on rubber will be prepared soon. Dr. Felix Yerzley, chairman of the Plastics and Rubber Division, and S. C. Stillwagon, H. S. Spencer, Spencer Palmer, E. F. Lougee, and G. M. Kline were among the members and visitors who participated.

Accelerator for Self-Curing Goods

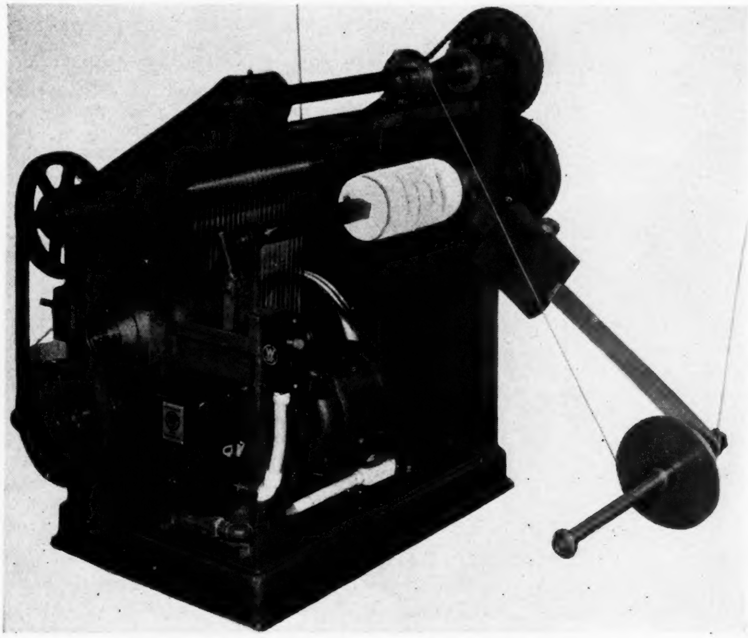
BUTYL EIGHT, a product of the R. T. Vanderbilt Co., 230 Park Ave., New York, N. Y., is an extremely active, low-temperature, dithiocarbamate type of accelerator for use in self-curing rubber goods. By its use goods of various kinds are enabled to cure at room temperature. It is used in rubber cements for making many single and double texture materials such as quarter-linings, vamp linings, shower curtains, and clothing. It also finds application in the production of certain self-curing calendered and tubed goods such as midsoling, red sheet packing, rubber-cork sheet packing, single- and double-texture proofed fabrics, and laboratory and drug sundries tubing.

Owning to the speed of Butyl Eight certain precautions are necessary in processing. It is said that the heat which remains in the stock after processing is sufficient to start the curing which usually proceeds to completion during overnight storage at ordinary room temperatures.

New Machines and Appliances



Eight and One-Half-Inch Royle Strainer with Manually Operated Head, Rotary Stock Cut-Off Knife, and Knife Safety Guard



Howe Normalizer for Belt Cord Viewed from Take-off Side

Stretch-Reducer for Belt Cord

THE purpose of the Howe cord normalizing machine is to remove the stretch from cotton cord before it is manufactured into V-belts. As the cord comes from the cotton mill, it generally has an elongation factor of from eight to 12%. To prevent excessive belt stretch in service it is desirable to reduce the stretch in the cord before constructing the belt. Normally from ½ to 1% of stretch is left in the cord after treatment.

The Howe machine for reducing stretch comprises two motor-driven tapered rolls, each 20 inches long and having 30 grooves. The groove diameters progress from two inches at the small end to five inches at the large end. The cord which comes directly from the latex dip tank is threaded over successive pairs of grooves, starting at the small end of the rolls. Owing to the progressive increase in roll diameter, each succeeding loop of the cord is of an increased length. Any predetermined amount of stretch may be removed, depending upon the number of grooves the cord passes over before being led from the machine. After this normalizing or stretching process, the cord passes through a drying tower (not shown in the photograph) and is then wound upon a spool mounted on the machine. The finished cord is said to become on an average 22% smaller in diameter and greatly improved in tensile strength. A belt using the normalized cord has a very low stretch and is cool running, it is claimed.

The Howe unit is powered by a three h.p. motor through a V-belt drive, has a capacity of 200 feet per minute, and is said to be suitable for any practical size of belt cord. The machine including the motor weighs approximately 1,500 pounds and is 4½ feet long, two feet wide, and 3½ feet high. Howe Machinery Co., Inc.

Strainer with Easy-Opening Head

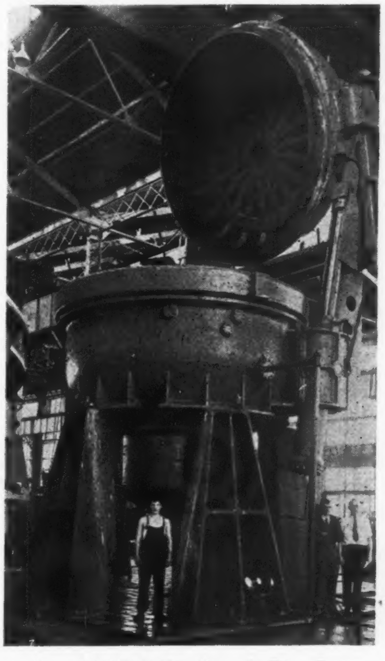
A NEW Royle strainer utilizes a manually operated, breech-locked strainer head of the gate type. The breech lock, which is operated by lever, presents a new-type straining machine closure that is said to facilitate the opening of the huge gate head for cleaning purposes. A powerful gear assembly is utilized, transmitting six tons' pressure to the locking ring when a fifty-pound lever pull is made. To unlock and fully open the head, it is only necessary to lift the ratchet lever once and turn the handwheel less than one turn. After cleaning, relocking is accomplished by the use of the handwheel alone. John Royle & Sons, Inc., Paterson, N. J.

Giant Tire Vulcanizer

A HUGE tire vulcanizing press, believed to be the largest of its type ever built and capable of curing tires up to approximately 10 feet in diameter, was completed recently by the Baldwin-Southwark Corp., Philadelphia, Pa., for the Firestone Tire & Rubber Co., Akron, O.

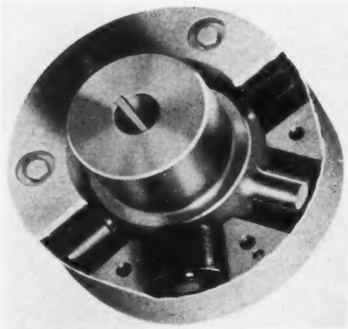
Standing 18 feet high with the lid closed and 30 feet high with the lid open, the press has a clear inside diameter of 150 inches and a five-foot high mold space. When installed, however, only seven feet six inches of the press will appear above the floor when the lid is closed. The main ram is chromium-nickel-cast-iron, is 68 inches in

(Continued on next page)



Huge Baldwin-Southwark Tire Press

New Goods and Specialties



Cutaway View of Morflex Coupling

Radial Couplings

SPECIALLY shaped patented rubber bushings are used in the Morflex radial coupling to provide an effective flexing medium for withstanding shock loads and resisting vibration. These rubber blocks are assembled radially, equally spaced, on the steel pins of the yoke or hub member. A two-piece metal housing encases the rubber blocks and also provides for attaching the companion flange to the unit. The coupling is machined to insure perfect balance. Since there is no metal on metal movement, the coupling is fully insulated against noise and electricity and requires no lubrication. It is made in various sizes with capacity ratings of from 2 to 37 h.p. at 100 r.p.m. Morse Chain Co.

Sponge-Backed Hospital Sheeting

SPONGEGRIP is the name given to a rubber hospital sheeting made with a sponge rubber backing to insure non-slipping and thus eliminate the necessity of using straps, clamps, pins, etc. to hold the sheeting in place. Stedfast Rubber Co., Inc.

Latex Sponge Blackboard Eraser

AN EFFICIENT washable blackboard eraser comprises a ½-inch thick piece of Airfoam, the Goodyear Tire & Rubber Co.'s whipped latex sponge product, mounted on a backing of stiff rubber flooring material, $\frac{1}{16}$-inch thick. Jefferson Sales Co.

U. S. Sand Tire

THE U. S. Royal "Sand Special" tire, originally designed for trucks and trailers in the Arabian oil fields, is now being offered for general use on small trucks operating in sandy country and at bathing beaches. The tire is made in two sizes, 9.00-13 and 9.00-15, and has a seven-rib tread design. The outside

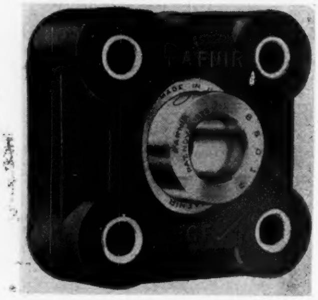
Low-Pressure Sand Tire

M.S.A. All-Vision Facepiece

ribs are formed into blocks with connecting links; while the inside ribs are of the bramble type with pointed projections and corresponding indentations in the sides of the ribs. The low inflation pressure required is said to provide excellent flotation on sand. U. S. Tire Dealers Corp., 1790 Broadway, New York, N. Y.

Wide-Vision Facepiece for Gas Masks

AN ALL-VISION facepiece for gas masks, made of molded rubber, has been designed so that the wearer's entire normal vision is unrestricted without having extra glass to pick up reflections or add unnecessary weight. Dead air space has been reduced so as to decrease the rebreathing of exhaled air. By means of a new type



Rubber Insulated Bearing Cartridge

deflector, the incoming air stream is directed over the entire area of the lens, thus preventing fogging. The soft rubber facepiece is said to follow the contour of the face with minimum tension of headbands. Thus "pressure points" that cause headaches and fatigue are eliminated. The facepiece has been adopted as standard for all M.S.A. gas masks. Mine Safety Appliances Co.

Resilient Bearing Cartridges

BOTH flange and cylindrical bearing cartridge units now utilize a resilient housing of rubber which electrically insulates the bearing, absorbs noise and vibration, and compensates for small errors of alinement and longitudinal shaft expansion. Each unit embodies a Fafnir wide inner ring ball bearing with self-locking collar and can be installed without machining, locknuts, sleeves, or adapters. Both the rubber flange cartridge (illustrated) and the cylindrical unit are made for all standard shaft diameters from ¾-inch to $1\frac{7}{16}$ inches. Fafnir Bearing Co.

Giant Tire Vulcanizer

(*Continued from preceding page*)

diameter, and has a 40-inch stroke, operating in a bronze bushed cylinder. Operating as it does at 1,000 pounds per square inch hydraulic pressure, the press is capable of exerting a 2,000-ton pressure on the molds, and with the 100-pound steam pressure inside, a total load of 2,500 tons is exerted upon the lid locking device.

Two copper-lined lid lifting cylinders with stainless steel piston rods are operated with an equalizing mechanism. The lid and top mold section that must be lifted weighs over 115,000 pounds. A hydraulic cylinder actuates the locking ring for securing the lid to the main shell during the processing period. A safety mechanism locks the lid when it is in the open position to prevent its dropping in the event of power failure.

UNITED STATES

Business Continues Upswing Based on Anticipated War Demands and Increase in Seasonal Trade

The rise in industrial activity, started in August, was accelerated in September with the advent of war in Europe, and industrial output is expected to reach 1937 levels. Domestic demand is high, but actual consumption does not appear to be keeping pace with production. European buying, expected to increase considerably, probably will not be of the volume or at the price levels of the 1915-18 period.

Employment and payrolls are up, and a shortage of skilled workers exists in many industries. The reduction of the standard work week is likely to increase employment of unskilled labor and retard skilled labor operations.

Construction business has gained; domestic orders for machinery and tools have increased so as to extend delivery periods to from three to six months. Increases have been reported in coal, electrical appliances, plate glass, and leather shoe production. Freight car loadings surpassed those of 1930, and current orders for new cars exceed the number in service in 1938. Cotton mills are operating at about 80% of capacity, with orders the largest in history. For industrial fabrics delivery on current orders approaches February, 1940. Steel ingot production continued to rise to 91% of capacity, the highest since April, 1937, although actual tonnage in October was the greatest on record. Automobile production, except in plants where labor trouble is harassing manufacturers, has increased rapidly because of the demand for the new 1940 models.

Most rubber manufacturing lines are reported good, and it is believed that October consumption of both crude and reclaimed rubber will show an increase. The demand for synthetics and compounding ingredients is very good. Suppliers of rubber working machinery are busy, presumably on orders largely for plant improvement. Orders for new equipment tires and automotive parts are increasing, and replacement business is holding up well. The call for insulated wire and hard rubber goods is very marked, and mechanical goods, showing good volume, have been advanced in price to overcome rising costs of rubber and cotton. Many New Jersey rubber manufacturers, who are running 24 hours a day and with increased shifts, feel that most of the demand is due to expectation of higher prices. In New England many schedules have been enlarged to care for increased orders which are thought to be for current demands and not as protection against price advances.

A quite natural concern as to regular supplies of crude rubber has arisen, particularly among companies with limited storage, but thus far indications are that ample provisions are being made. In general, optimism is prevalent, but there appears some feeling that this rapid increase in business may be too highly anticipatory and possibly incapable of being sustained.

CALENDAR

Nov. 3. Akron Rubber Group. Akron City Club.
Nov. 7. Los Angeles Rubber Group. Mayfair Hotel.
Nov. 10. Chicago Rubber Group. Hotel Sherman.
Dec. 4-8. American Society of Mechanical Engineers. Hotel Bellevue-Stratford, Philadelphia.
Dec. 4-9. 17th Exposition of Chemical Industries. Grand Central Palace, New York.
Dec. 8. Boston Rubber Group.
Dec. 15. New York Rubber Group. Christmas Party. Building Employers' Trade Association, 2 Park Ave.

EASTERN AND SOUTHERN

Machinery Executives Return from Europe

A close-up view of European war conditions was granted Nils Florman, president, and J. R. Stricklen, vice president, of the National Rubber Machinery Co., Akron, O., who arrived safely in New York from England on September 27 on the *S. S. Orizada*, together with 240 survivors of the British ship *Athenia*, sunk on September 3 by a submarine. Messrs. Florman and Stricklen sailed for Europe on August 16 on the *S. S. Normandie* with the intention of visiting several countries including Switzerland, France, Belgium, and England. When they reached Paris, however, they found mobilization well under way, and business, for the moment, at least, marking time. After four days in the French capital they flew to England and made their headquarters with David Bridge & Co., Ltd., Manchester, their European representatives.

After transacting essential business the National Rubber Machinery Co. executives experienced the thrills of wartime England with nightly black-outs, air-raid alarms and the rush to shelters, troop movements, etc., while waiting for an opportunity to board ship for home. Though on an American vessel, they experienced an exciting submarine alarm while in mid-ocean.

National Rubber Machinery Co. Officials after Arrival in New York on S. S. Orizada: (Left to right) A. De Ghetto, Plant Mgr., Clifton, N. J.; Vice President S. A. Fraine; Mr. Florman; and Mr. Stricklen

Both men agree that, from personal observation, both England and France are thoroughly prepared for a long and energetic war and that the citizens of both countries appear resigned to make the necessary sacrifices.

Mechanical Prices Up

Owing to the rising costs of raw materials, particularly rubber and cotton, and uncertainty of commodity markets some manufacturers are raising prices of mechanical rubber goods, which, moreover, are subject to further change without notice, and delivery of these products will be contingent on certain conditions. Effective October 1 price increases were announced by The B. F. Goodrich Co., Akron, O.; Lee Rubber & Tire Corp. (Republic Rubber Division), Conshohocken, Pa., and United States Rubber Co., 1790 Broadway, New York, N. Y.

Ty-Ply Marketed by Vanderbilt

R. T. Vanderbilt Co., 230 Park Ave., New York, N. Y., is offering Ty-Ply, a new adhesive for bonding rubber and synthetics to metal. A descriptive booklet is available. This adhesive was developed and is manufactured by The Marbon Co., Inc., Gary, Ind.

Ty-Ply is supplied in two types—Ty-Ply "R" for use with rubber, and Ty-Ply "S" for use with Neoprene, Perbunan, "Thiokol," and some resins. These adhesives may be applied to metal by brushing, spraying, or dipping. The bond is very strong, and its resistance to oil and water is claimed most satisfactory. Ty-Ply is not suitable for use on brass; it is offered as a good means of bonding rubber to metal without brass plating. Ty-Ply is suitable for use with a great variety of compounds—sulphurless, low sulphur, normal sulphur, high sulphur—in a wide range of Shore hardness. This adhesive is unique in that but one very thin coat is required on the metal, and drying without baking suffices.

Latex Foam Cushioning Featured at the New York Automobile Show

Increased rubber usage was an important feature of the 1940 car models on display at the Fortieth National Automobile Show at the Grand Central Palace, New York, N. Y. from October 15 to 22, inclusive. Passenger cars shown included 19 American cars and one of English make, with ten different commercial vehicles. The new models in general do not reflect any radical changes in design, but rather incorporate refinements and improvements intended to provide safer and more comfortable travel.

From the rubber manufacturer's viewpoint the most significant feature of this year's models is the more widespread adoption of latex foam seat cushions. These cushions are used generally over a regular foundation of nested coil springs. The cushion thickness varies considerably with different car makes, and in some cases it is topped with a cotton or wool padding. The rubber cushion is offered on some or all models by 14 of the 19 American makes on display.

In many chassis and body applications the amount of rubber used has been increased. Rubber bushings are used more and more in spring shackles and equalizer bars and in rubber-insulated joints for steering and shock absorber connections. Where running boards have been further narrowed or disposed of a protective sheet of rubber over the front end of the rear fender has been quite generally adopted.

In the different car makes many innovations and changes relating to rubber usage have been made. Among these are: Pontiac—new shear-type engine mounts, new rubber-cotton (tire-carcass type) body mounts, rubber front fender flap; Chevrolet—a three-point rubber mounting for fuel tank to replace strap mounting; plastic gear shift knob with a rubber core; Buick—section of Neoprene hose in fuel line to damp out noises from fuel pump, redesigned rear engine-mounts with the front surface of the rubber not vulcanized to the metal on the inside of the mounting; Chrysler—sponge rubber door seals which extend completely around the inner edge of the outer flange of all doors.

Concurrent with the national auto show, three supplementary special showings were held in New York: General Motors Corp. at the Hotel Waldorf-Astoria, Ford Motor Co. at the Hotel Astor, and the Chrysler Corp. in its International Salon in the Chrysler Building.

Premium Show

The Fifth Annual Atlantic Coast Premium Buyers' Exposition was held at the Hotel Astor, New York, N. Y., October 2 to 6 under the auspices of Premium Advertising Association of America, Inc., New York. Included among the 108 exhibitors were: Barr Rubber Products Co., Sandusky, O., which showed a complete line of toy balloons, balls, bathing caps, playthings for dogs, and other toy novelties; Eagle Pencil Co., 703 E. 13th St., New York; Plymouth Rubber Co., Inc., Canton, Mass., represented by Lindley & Schwarz, 220 Fifth Ave., New York, which exhibited electrical appliances, pens, pencils, and sets, rubber aprons, beach balls, bridge table covers, and shower caps; and Universal Tray & Sign Co., 32 W. 18th St., New York, which featured soft rubber key cases and Spell-O-Tex sponge rubber letters for display purposes.

The Thermoid Co., Trenton, N. J., according to President F. E. Schluter has adopted a profit-sharing plan for employes, effective on October 30, but to be made retroactive from September 1, whereby all workers earning less than $200 monthly will share in 20% of the average net profits of the company's local operations for each preceding quarter after monthly reserves for federal income taxes, $10,000 preferred stock dividend claims, and $5,000 for contingencies or errors have been deducted.

A.S.T.M. Approves Standards

Standards Committee E-10 of the American Society for Testing Materials has approved two new tentative standards for testing rubber. One of these (D 552—39T) covers chemically blown sponge rubber, expanded cell-tight sponge rubber, and foamed latex sponge rubber. The other (D 553—39T) presents methods for testing rubber cements for total solid content and viscosity.

Du Pont Personnel Activities

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., at a recent meeting of the board elected H. B. du Pont, assistant to the president since July, 1938, a vice president and a member of the executive committee, the membership of which was increased from nine to ten. Mr. du Pont, who is 41 years old and a graduate of Yale University and the Massachusetts Institute of Technology, was with General Motors four years as a research engineer, before joining du Pont in January, 1928. Following a few months in the treasurer's department, he turned to engineering work, first with the ammonia department and then for seven years with the engineering department, being in charge of its technical division nearly four years.

On October 16 du Pont announced the voluntary resignation of T. S. Grasselli as a member of the executive committee, effective November 14, his sixty-fifth birthday. But Mr. Grasselli will continue as a vice president and a director of the company.

Ernest Bridgwater, manager of du Pont's Rubber Chemicals Department, has resumed his duties after an emergency appendectomy in Bermuda where he had been spending his vacation. Upon arrival in New York on September 19 on the *American Clipper,* Mr. Bridgwater went to Wilmington where he has now completely recovered.

Perkin Medal Award

Dr. Charles M. A. Stine, vice president in charge of research at the du Pont company will receive the Perkin Medal of the Society of Chemical Industry for 1940. The award will be made on January 12 at the Chemists' Club, 52 E. 41st St., New York, N. Y.

Strike Settled at Puritan Rubber

The strike which involved 110 employes of the Puritan Rubber Co., Trenton, N. J., after nearly eight weeks was settled with the signing of a new agreement between management and workers. One of the provisions reads that in the event of the United States entering the war, any union members, upon completion of their service for the government, will be returned to their jobs without loss of seniority rights or factory service. The company also agreed to rescind its proposal for a cut in wages, while the union withdrew its demand for a general wage increase. The right to reopen negotiations on wages should war or other conditions produce an increase in the general prosperity is reserved by the union. There was also a conditional vacation clause. Miah Marcus, of Roxbury, Mass., treasurer of the company, signed the agreement for the concern.

Hewitt Rubber Corp., Buffalo, N. Y., has appointed Arthur Purmort and Nathaniel Ware as district representatives. The former will cover the St. Louis and Indianapolis territories; while the latter has been assigned to the Boston office covering New England.

Hewitt, which recently completed an order for 800,000 feet of fire hose from Great Britain, has received another order from that nation, for 500,000 feet of hose to be used to augment fire fighting equipment in districts that might be subject to air attack.

Lambertville Rubber Co.'s former plant, Lambertville, N. J., has been purchased by a furniture company.

U. S. Tire Dealers Corp., 1790 Broadway, New York, N. Y., has added to its general sales department Elmer J. Lang, former president, Lang Body Co., Cleveland, O., and more recently manager, transportation division sales of American Seating Co., Grand Rapids, Mich. He will be engaged in sales research.

Supply Contracts Let

The United States Labor Department, Washington, D. C., recently announced the awarding by federal agencies under the provisions of the Public Contracts Act of the following supply contracts: Civil Aero. Auth.: cable: Habirshaw Cable & Wire Division, Phelps Dodge Copper Products Corp., New York, N. Y., $49,920; Navy: cable: General Electric Co., Schenectady, N. Y., $14,205, Habirshaw Cable & Wire, $64,452, Okonite Co., Passaic, N. J., $29,120, Phelps Dodge, $14,473, Rockbestos Products Corp., New Haven, Conn., $27,953, John A. Roebling's Sons Co., Trenton, N. J., $32,196, cable and wire: General Electric, $33,515, packing: Manhattan Rubber Mfg. Division, Raybestos-Manhattan, Inc., Passaic, $9,720, masking tape: Industrial Tape Corp., New Brunswick, N. J., zinc oxide: American Zinc Sales Co., New York, $31,250; Panama Canal: cable: Habirshaw Wire & Cable, $26,435, gate valves; Jenkins Bros., Bridgeport, Conn., $38,815; War: cable: Roebling's Sons, $16,040, elastic cloth: American Woolen Co., New York, $754,936, J. P. Stevens & Co., Inc., New York, $58,800, overshoes: United States Rubber Co., Naugatuck, Conn., $27,170; WPA: cable: Quayle Electric Supply Corp., New York, $20,-420.

B.L.M.A. Election

Brake Lining Manufacturers' Association, Inc., 370 Lexington Ave., New York, N. Y., on September 21 held its annual meeting at which the following officers were elected: R. B. Davis, of Raybestos-Manhattan, Inc., president and member of the executive committee; T. L. Gatke, Gatke Corp., first vice president and member of executive committee; A. C. Teetsel, Ferodo & Asbestos, Inc., second vice president and member of executive committee; J. S. Crawford, Johns-Manville Corp., treasurer and member of executive committee; C. A. Ekwall, secretary, general manager, and assistant treasurer; F. E. Schluter, of Thermoid Co., H. A. Gillies, of American Brake Shoe & Foundry Co., G. M. Williams, of Russell Mfg. Co., C. P. Brockway, of World Bestos Corp., F. I. Marshall, of Bendix Aviation Corp., additional members of executive committee.

Jos. Stokes Rubber Co., Trenton, N. J., is operating 24 hours a day in the production of hard rubber. The Canadian plant is also busy. Lloyd Leaver, for some years with Hamilton and Thermoid rubber companies, has been added to the Stokes sales staff.

Martindell Molding Co., Inc., Trenton, N. J., plans an extension to its new plant for the manufacture of hard rubber specialties. The company at present makes molded products and reports good business.

The Pocono Co. Reorganizes

The Pocono Co., Trenton, N. J., recently completed its reorganization marked by the resignations of Neil E. Bowman, long president of the company, and of Benjamin Haber and James A. McQuillen, permanent trustees since the Summer of 1938, and the election of the following officials: president, Victor S. Pollak, vice president, Joseph Pugh; secretary-treasurer, Joseph B. Kiefer; and assistant secretary and executive officer, Howard Miller. The company also reports that business has shown a sharp gain and the working force has been increased.

Lee Rubber & Tire Corp., Conshohocken, Pa., according to President A. A. Garthwaite, is operating its tire division at full capacity on a six-day basis, and tire unit sales for the year ended October 31 were the largest in the history of the company. The mechanicals division, Republic Rubber, Youngstown, O., is running on a substantially higher basis than during last year, which, however, was below normal in regard to sales.

L. Albert & Son, Trenton, supplier of rubber mill machinery, reports its Ohio plant is operating 24 hours a day with export business up 50%. The firm is busy too at its Jersey and California plants.

Halbach Honored

Ernest K. Halbach, president and chairman of the board, General Dyestuff Corp., 435 Hudson St., New York, N. Y., in commemoration of his fortieth anniversary in the business, was guest of honor at a dinner on October 6 at the Hotel Waldorf-Astoria tendered him by business associates and company executives. Mr. Halbach is also head of a Dyestuffs Group which has been organized in New York to aid the twenty-third annual membership roll call of the New York Chapter of the American Red Cross, 315 Lexington Ave., which begins on November 11.

Fox Laboratories recently was established at 17 W. Third St., New York, N. Y., where a line of latex cements and adhesives will be manufactured and technical service supplied. Edward G. Fox, the proprietor, formerly was a technical consultant in the rubber industry.

Jenkins Bros., 80 White St., New York, N. Y., through Sales Manager W. J. Frisby announced that Howard C. Ickes has joined its tire valve division. Mr. Ickes, who was with the Firestone Tire & Rubber Co. for several years, will act as field engineer, contacting tire manufacturers, and will make his headquarters at the Jenkins office in Akron.

PACIFIC COAST

NAITD Adopt Resolution for Better Relations with Tire Makers at San Francisco Convention

The National Association of Independent Tire Dealers held its nineteenth annual convention at Sir Francis Drake Hotel, San Francisco, Calif., October 9-11, at which M. U. Moseley, of the Dixie Tire Co. (Seiberling), Miami, Fla., was elected president and F. L. Hawkins, Commercial Automotive Service (Goodyear), Seattle, Wash., vice president. Quite noticeable during the sessions was the sentiment favoring closer and friendlier relations between the NAITD and its members and tire manufacturers, which was reflected in some of the resolutions adopted, including one providing for the appointment of an advisory committee of dealers to meet and consult with The Rubber Manufacturers Association and/or executives of tire manufacturers relative to merchandising policies on all matters of mutual interest. But it was emphasized that the dealer body would continue its independence of action and protest those industry policies and practices considered inimical to dealer interests.

Much interest was also displayed in retreading. The trade show, held in conjunction with the convention, received considerable attention.

Among the representatives of tire and tube manufacturing companies frequenting the convention were: J. W. Whitehead, president, Norwalk Tire & Rubber Co., Norwalk, Conn.; C. W. Ort, divisional manager, U. S. Tire Dealers Corp., 1790 Broadway, New York, N. Y.; C. B. Reynolds, Pacific Coast manager, Seiberling Rubber Co., Akron, O.; J. T. Clinton, of Falls Tire & Rubber Co., Findlay, O., which had a special exhibit at the Hotel Californian; and Paul A. Polson, vice president, A. V. Rodman, California district manager, and J. Weled and A. R. Biggs, Los Angeles and San Francisco territory men, respectively, all of Polson Rubber Co., Garrettsville, O., which had a booth displaying the varied line of Polson tubes at the trade show. Also among the exhibitors was the Bibb Mfg. Co., Macon, Ga., which featured its Bibb Heat-Resistant Cotton Cord.

Stauffer Chemical Co., Dominquez Chemical Co., Pacific Hard Rubber Co., and **Western Molded Products, Inc.,** recently moved their Los Angeles, Calif., offices to 555 S. Flower St.

OHIO

Goodrich Records

The B. F. Goodrich Co., Akron, recently received two orders for cotton rubber-lined fire hose from the British Government, one for 400,000 feet and the other for 245,000 feet.

New Touring Record

Driving a 1940 Willys Speedway coupe equipped with Goodrich four-ply non-skid Silvertown Life-Saver tires, Bob McKenzie of Los Angeles, Calif., and Relief Driver Robert Charest, of Aurora, Ill., left the Goodrich arena at the New York World's Fair at 9 p.m. October 1 and returned at 6:30 p.m. October 11 after having touched every state in the Union on their 9,896-mile tour, for which they had a grand average of 41.66 miles per hour, timed officially by Western Union. For 3,000 miles they encountered dirt and gravel roads and in some instances hardly any road at all. It rained at least some part of eight of the ten days, and temperatures varied from 78 to 30° with six inches of snow. Nevertheless Mr. McKenzie reported they did not have a single blowout or cut one tire or skid once. He checked the tires for pressure and inspection thrice, and they were examined again at the end of the run.

New Demonstration Record Claimed

A new industry record of tire demonstrations to 20,000,000 persons is believed to have been set by the Goodrich company at its World's Fair Arena and in dealer outlets during the past six months, Guy Gundaker, Jr., director of the company's Fair activities, announced recently. More than 5,000,000 persons have been registered on electric-eye counters at 1,159 demonstrations of non-skid tires and self-sealing tubes by Daredevil Jimmy Lynch on the Arena's wet, banked tracks. An additional 15,000,000 personal tests have been given in company stores and dealer outlets with the aid of a specially designed gadget using a glass runway and water to test skid resistance, Mr. Gundaker estimated.

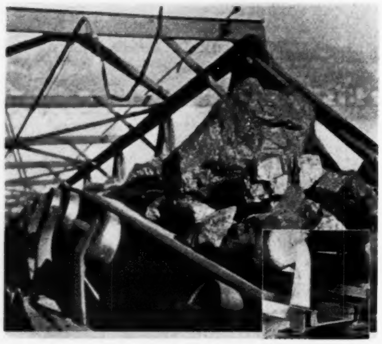
New Passenger-Car Battery

Goodrich recently announced the Glasstex battery, a new passenger-car unit with a guarantee of 27 months or 27,000 miles of service. The battery features fiber glass mats of new design to retain the active material in the positive plates. Some of the new batteries are equipped wih the patented power-saving top cover; while others have the Goodrich non-flood device.

Goodrich Ads Win Prize

Among the 20 series of industrial advertisements selected as the best of the year by a jury of the National Industrial Advertisers Association at its recent annual conference in New York was a group of 23 from the Goodrich company, prepared by H. E. Van Petten, advertising manager, mechanical division, and entered in the Materials classification.

A bronze plaque accompanied by a letter from the N.I.A.A. president was sent to a designated officer of each winning corporation; while a certificate of merit was forwarded the advertising manager.



A belt that led with its chin always took the count

A typical example of Goodrich development in rubber

Goodrich

One of the Prize Winning Goodrich Advertisements, Featuring a Conveyer Belt for Huge Rocks, Etc., Made Longer Wearing by the Use of Rubber Springs for the Pulley Supports

Supreme Court Upholds Legality of Goodyear's Tire Contracts with Sears, Roebuck

Climaxing six years of litigation over contracts made by the Goodyear Tire & Rubber Co., Akron, to manufacture tires for Sears, Roebuck & Co., Chicago, Ill., the United States Supreme Court this week refused to review decision of the Sixth Circuit Court of Appeals which ruled in 1938 that a cease and desist order of the Federal Trade Commission issued against Goodyear should be vacated.

The Federal Trade Commission had alleged that Goodyear's prices to Sears were discriminatory under terms of the Clayton Act. Goodyear, in its defense, maintained that its prices to Sears were justified on account of the quantities involved and were therefore permitted under the law.

Commenting on the Supreme Court's final disposition of the case this week, P. W. Litchfield, of Goodyear, issued the following statement:

"The Supreme Court of the United States this week refused to review the decision of the Sixth Circuit Court of Appeals in the Federal Trade Commission proceeding against Goodyear. This proceeding involved the legality of our tire contracts with Sears, Roebuck & Co. The Supreme Court decision makes final the prior decision of the Circuit Court of Appeals, which had set aside the Commission's order against Goodyear, and thus terminates the long drawn out litigation over our Sears contract.

"The decision of the Circuit Court of Appeals establishes that the Federal Trade Commission was wrong in concluding that Goodyear's contracts with Sears violated any law in effect, when those contracts were made and performed. The decision, therefore, means that, prior to the passage of the Robinson-Patman Act in 1936, the type of arrangement which Goodyear had with Sears was fully justifiable, and that the attacks on Goodyear by reason of it were unwarranted. Needless to say, we are very much gratified by this final vindication of our policies."

Cuts Debt

During September Goodyear paid off $3,000,000 of $8,000,000 in promissory notes. The remaining $5,000,000 has been refunded with the five promissory notes to the same payee maturing serially to September 1, 1944.

Resumes Radio Program

Offering a well planned balance of entertainment and timely localized agricultural information, Goodyear returned to the air the week of September 24 with its Farm Reporter radio program through the facilities of 15 major Farm Belt radio stations. Interspersing pertinent local market and crop reports with popular folk songs, hymns, and dance music, the program is broadcast for 15 minutes between 12 noon and 1:00 p.m. one day each week.

New Sales Representative

Goodyear has taken on as special representative in its battery sales department Paul F. Jones, formerly in charge of the Chicago and Kansas City districts for The Willard Storage Battery Co.

Pliofilm Fabricating Becomes a Home-Craft

Plio-Crafting, a new, practical home-craft for the fabrication of Pliofilm articles by heat-sealing or sewing, was introduced recently by M. O'Neil Co., one of the leading department stores of Akron and is now being promoted nationally by its sponsors, The Butterick Co., Inc., New York, N. Y., Dennison Mfg. Co., Framingham, Mass., and Singer Sewing Machine Co., New York. Butterick is making special patterns for this purpose; while Dennison is offering handy household rolls of Pliofilm and instruction sheets for making many useful articles as rain capes, garment and blanket bags, silverware protectors, shower curtains, baby bibs and pants, lingerie cases, utensil and bridge

table covers, etc. The Singer company will offer free instructions in fabricating and sewing with Pliofilm in its hundreds of sewing centers throughout the country. Film-Tex Products Co. is supplying binding tape and ribbon.

Supporting the general program, the Goodyear Pliofilm distributers, Richards, Boggs & King, Chicago, Ill., and the Dennison company, are supplying through their retail department and stationery store outlets the Pliofilm by the yard and in handy rolls, including 24 transparent, opaque, and metallic colors in 20- and 40-inch widths.

A specially designed, yet simple little electric sealing iron is available for making up smaller articles and for women who do not care to sew.

F. A. Seiberling Feted

The eightieth birthday of Frank A. Seiberling, dean of the rubber industry and founder and chairman of the board of The Seiberling Rubber Co., Akron, was celebrated on October 6 with an eightieth anniversary ball in his honor at which employes of the company presented him with a bronze plaque reading:

To
FRANK A. SEIBERLING

Not for his great deeds and material accomplishments, not for what these things have meant to us, but rather for the man himself, who through his vision, faith, courage, fortitude and unswerving devotion to the highest ideals, has served as a beacon light to guide us on to lives of greater freedom, worth and happiness.

Presented To The Founder Of
The Seiberling Rubber Company
On His Eightieth Birthday, October 6, 1939
In Grateful Appreciation
From His Fellow Workers

Messages of congratulations poured in including felicitations from President F. D. Roosevelt and John Bricker, governor of Ohio.

The Firestone Tire & Rubber Co., Akron, on October 1 through operations of its sinking fund redeemed 1,471 of its ten-year, $1,000 3½% debentures due October 1, 1948, at 103% of the principal amount plus accrued interest to the date of redemption.

NEW ENGLAND

Armstrong Cork Expands South Braintree Operations

Armstrong Cork Co., Lancaster, Pa., will add to the reenforced rubber tile products manufactured at the Armstrong-Stedman plant at South Braintree, Mass., mechanical rubber, shoe, and textile specialties now made at Lancaster, production of which will begin at South Braintree early in 1940 as soon as movement of machinery, erection of a new building, and other facilities can be completed. Mechanical rubber goods include those of cork, rubber, and synthetic rubber, as hydraulic caps, packings, couplings, oil seals, cork fabric for setting glass in windows, and a soft cushiony underlisting for golf club handles. Shoe products cover box toes, sole stock, and cushion cork; while textile products include cork, rubber, and synthetic rubber as roll coverings, ribbon materials for loom rolls and cloth measuring machines, and a new product of synthetic rubber, long draft prongs.

The entire South Braintree operations are in charge of William G. Brooks, general superintendent of the plant. Mr. Brooks, a native of Boston, who graduated from Tufts College in 1915, joined Stedman in 1918 and continued as superintendent upon the acquisition of the business by Armstrong.

Annual Outings Held

Approximately 750 members and guests of the Rubber Workers Union of the Goodyear Footwear Corp., Providence, R. I., recently attended the annual outing and field day at Crescent Park. The numerous guests included Alfred Lingley, company president, Vice President William C. Warring, Jr., Treasurer Everett E. Murch, Superintendent John J. Parker and Arthur J. Davis, purchasing agent. There was a long program of sports and games. A typical Rhode Island shore dinner completed the afternoon's festivities; while dancing furnished enjoyment until a late hour.

The annual outing and field day of the Pawtucket and Central plants of the Collyer Insulated Wire Co. recently was held at Shawomet Beach, with over 500 enjoying the most elaborate program ever arranged by this group. Luncheon of chowder and clamcakes was served at noon, and the sports card preceded the bake at 5:30 p.m.

United States Rubber Co. plant in Providence, R. I., employing approximately 2,100 workers, has announced a new vacation plan, effective June 4, 1940, whereby all wage employes with more than five years' continuous service will be given an annual vacation of two weeks with pay, equal to 4% of the employe's earnings for the previous year. About 900 persons will be eligible, according to J. Ronald Brogden, personnel manager. The plant has had in operation for three years a plan whereby one week's vacation with pay was given to employes who had worked more than one year continuously. This plan will be continued so that 90% of the employes will receive vacations with pay under one plan or the other.

Arnold Mfg. Co., which has commenced the manufacture of elastic yarn at 40 Church St., Pawtucket, R. I., brings a new industry to that city. J. Jenks Arnold, of Saylesville, R. I., head of the organization, has been connected with the textile industry specializing in wool for the past 15 years.

Thompson, Weinman & Co., Inc., has moved its research laboratory, which is under the direction of Dr. A. R. Lukens, from Cambridge to 8 Hartwell Place, Waltham, Mass. The company produces carbonate fillers.

The Vultex Chemical Co., Cambridge, Mass., has announced the election of H. Stuart Hotchkiss as chairman of the board, a newly created office. H. J. Elwell and K. B. Osborn continue as president and vice president, respectively, of the company. Mr. Hotchkiss, who is also president of the Cambridge Rubber Co., Cambridge, Mass., has long been a prominent figure in the rubber industry.

Pay rolls of rubber manufacturers in Rhode Island during September amounted to $285,718, 10% more than in August and 3.6% more than in September, 1938, according to the Brown Bureau of Business Research.

Kinnecott Wire & Cable Co., Inc., is erecting a connecting structure of steel and brick, 20 by 82 feet, between buildings No. 14 and No. 18 at its plant on Bourne Ave., East Providence, R. I., to cost approximately $10,000.

MIDWEST

Monsanto's Present Price Policy

Monsanto Chemical Co., St. Louis, Mo., recently informed its 30,000 customers by letter that with few exceptions its present selling prices yield a fair profit; so it will not increase selling prices of its products even though it may have an opportunity to do so, unless there are sound reasons for such action, and that a review of the more important raw materials does not indicate any reason for a precipitous rise in their cost. The statement also expressed the belief that there is ample installed capacity for all the products Monsanto manufactures to supply any normal domestic demands and a substantial share of export markets.

New Translation Service for Chemists

Hooker Scientific Library, Fayette, Mo., recently inaugurated a new literature service for chemists, offering translations and literature searches, backed by facilities for providing filmstat or photostat copies of any matter in the more than 20,000 volumes comprising the collection. The library will render these services at cost to members of the "Friends of the Hooker Scientific Library." Dr. Neil E. Gordon is director of the association and

head of the Department of Chemistry at Central College, owner of the library. Dr. Julian F. Smith, who recently resigned from E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., where he did chemical literature work, to become associate director of the "Friends of the Hooker Scientific Library," will have charge of the translation service, for he is well versed in German, French, Spanish, Italian, Portuguese, Dutch, Scandinavian, Polish, and Russian. The library, incidentally, has considerable material on rubber such as is found in a large and comprehensive library of chemical technology.

AMA Conference on Industrial Production

American Management Association, 330 W. 42nd St., New York, N. Y., will hold its conference at the Palmer House, Chicago, Ill., November 15 and 16, to be attended by hundreds of production executives, representing virtually every industry in the country, gathered to discuss modern production equipment and systems and especially industrial production problems caused by the war. Authorities on plant facilities, equipment, and methods will participate, as well as officers from the Ordnance Department of the U. S. Army, who will outline the army's plans for industrial coordination and preparedness.

The sessions are being planned by Raymond S. Perry, vice president of the Ingersoll Milling Machine Co. and of the AMA production division. Especial stress is to be placed upon factory design and modernization as a factor in cost reduction. Other topics include building design, plant services and unit costs, "plants of tomorrow" in operation today, lighting, heating, ventilation, air conditioning, and effects of environment on employe efficiency.

Ryko Mfg. Co., manufacturer of rubber molds and specializing in molds for mechanical rubber, recently opened a plant at 2557 W. Lake St., Chicago, Ill. E. H. Ryan, in the rubber mold industry for more than 25 years, and his associate, John Kozel, who also has had wide experience in this field, are connected with the new company.

Comprehensive Fabrics, Inc., 37 W. 27th St., New York, N. Y., according to President Joseph A. Kaplan, has licensed Warren - Featherbone Co., Three Oaks, Mich., to manufacture products of Koroseal treated material, including baby pants, bibs, aprons, dress shields, sanitary goods, shower caps, bindings, and other notions. Comprehensive Fabrics, recently organized, has distributer's rights to Koroseal. All articles made of Koroseal-treated fabrics and yard materials so coated will bear the copyrighted trade mark "K-Treated."

OBITUARY

Henry A. Van Dyck

HENRY A. VAN DYCK, long with the United States Rubber Co., 1790 Broadway, New York, N. Y., died in Cooperstown, N. Y., on September 27 of coronary thrombosis. Born in Schenectady, N. Y., on January 6, 1868, he was educated in the local grade schools, Albany Business College, and La Salle Extension University and was an accountant for various business firms for 24 years.

After office hours, from 1893 until 1908, when typewritten minutes were first used, Mr. Van Dyck wrote in long hand the minutes of U. S. Rubber in the official records of the company. On October 1, 1909, he started keeping the personal books of Col. S. P. Colt, then president of U. S. Rubber, and continued to do so until the latter's death. On November 1, 1913, the deceased became a member of the company's staff as an accountant in the secretary's office and later was placed in charge of Profit Sharing (July 1, 1916), in charge of the payroll department (January 1, 1925), and salary secretary (January 1, 1927).

Funeral services were conducted on September 29 at Cobleskill, N. Y., with interment at Bramanville, N. Y.

Surviving are two cousins.

P. E. Welton

P. E. WELTON, president of The Universal Engineering Corp., Akron, O., died on Columbus Day after a long illness. He was also connected with the former Akron Engineering Co., Patterson Engineering Corp., Akron, National Erie Co., Erie, Pa., The Adamson Machine Co., Akron, with the former McMyler Interstate Corp., Bedford, O., and the P. E. Welton Engineering Co., Akron. During years of prosperity his work consisted mostly of building small rubber companies in various parts of the United States and Mexico. His life work was mechanical and rubber engineering. At the time of his death he had twelve various patents on different types of rubber machinery.

Mr. Welton was born in Peninsula, O., February 5, 1877.

He leaves his wife, five children, and a brother.

William A. Means

AFTER a long illness William A. Means, former official of The B. F. Goodrich Co., Akron, O., died on October 7. He had joined the company in February, 1897, in the treasurer's department and became successively assistant treasurer (January, 1899), treasurer (January, 1910), second vice president (March, 1917), and first vice president (March, 1920, until he retired several years ago because of ill health.) Mr. Means was also a director from 1911 until his retirement.

He was born May 3, 1867, in Radnor Township, Ill., and attended Akron grade and high schools. The deceased belonged to the Masons and the First Congregational Church and was active in Akron civic life and charity circles.

Surviving are his wife, three daughters, and two grandchildren.

Funeral services were conducted on October 8. Burial was in Rose Hill Cemetery, Akron.

Wm. A. Donovan

AN EMERGENCY appendectomy led to the death, on October 2, of William A. Donovan, since January 1, 1933, sales supervisor of the Boston territory for The B. F. Goodrich Co., Akron, O. A native of Weston, Mass., (June 15, 1891) and an alumnus of its grade and high schools (1910), he joined Goodrich on December 26, 1911, as a credit clerk and received many advancements during his long service, broken only from May 1, 1918, until May 12, 1919, when he was in the army. Mr. Donovan belonged to the K. of C., B. P. O. E., and the American Legion.

Harry E. Evans

HARRY E. EVANS, 77, for a long time manager of the Consolidated Rubber Co., and former city treasurer of Trenton, N. J., died October 16 after a brief illness. Active in civic and fraternal affairs, he was one time treasurer of the Trenton Historical Society and belonged to the Masonic fraternity, Royal Arcanum and the National Union. A widower, he is survived by two sisters and a brother. Burial was in Greenwood Cemetery, Trenton.

FINANCIAL

Unless otherwise stated, the results of operations of the following companies are after deductions for operating expenses, normal federal income taxes, depreciation, and other charges, but before provision for federal surtax on undistributed earnings. Most of the figures are subject to final adjustments.

Boston Woven Hose & Rubber Co., Cambridge, Mass. Year ended August 31: net earnings, $220,350.92, equivalent, after providing $45,000 for dividends on 7,500 shares of preferred outstanding at the rate of $6 a share, to $2.04 a share on 86,000 common shares outstanding, against net loss of $202,151.56 in the preceding fiscal year; gross sales, $5,631,257.15, an increase of $832,803.19.

Canada Wire & Cable Co., Ltd., Leaside, Ont., Canada. Six months to June 30: net profit, $154,838, equal, after preferred dividend requirements, to

Dividends Declared

Company	Stock	Rate	Payable	Stock of Record
Armstrong Cork Co,	Com.	$0.25 interim	Dec. 1	Nov. 8
Armstrong Cork Co,	Pfd.	$1.00	Dec. 15	Dec. 1
Armstrong Rubber Co., Inc.	A & B	$1.00	Dec. 5	Nov. 20
Canadian Wire & Cable Co.	B	$0.25 interim	Dec. 15	Nov. 30
Canadian Wire & Cable Co.	B Pfd.	$1.62½ q.	Dec. 15	Nov. 30
Collyer Insulated Wire Co.	Com.	$0.10	Oct. 2	Sept. 26
Corduroy Rubber Co.	Pfd.	$1.00	Nov. 1	Oct. 25
Crown Cork & Seal Co.	$2.25 Pfd.	$0.56¼ q.	Dec. 15	Nov. 30
Dayton Rubber Mfg. Co.	Com.	$0.25 reduced	Oct. 25	Oct. 14
Dayton Rubber Mfg. Co.	A	$0.50 q.	Oct. 25	Oct. 14
De Vilbiss Co.	7% Pfd.	$0.17½ q.	Oct. 15	Sept. 30
Detroit Gasket & Mfg. Co.	Pfd.	$0.30 q.	Dec. 1	Nov. 15
Fisk Rubber Co.	Pfd.	$1.50 q.	Oct. 20	Oct. 10
Hewitt Rubber Corp.	Com.	$0.25 q.	Sept. 15	Sept. 1
Lee Rubber & Tire Corp.	Com.	$1.25* final	Oct. 28	Oct. 23
Mansfield Tire & Rubber Co.	$1.20 Conv. Pfd.	$0.30 q.	Oct. 1	Sept. 20
Midwest Rubber Reclaiming Co.	Com.	$1.25	Oct. 25	Oct. 14
Okonite Co.	6% Pfd.	$1.50 q.	Dec. 1	Nov. 17
Seiberling Rubber Co.	A Pfd.	$1.25 q. accum.	Oct. 30	Oct. 23
U. S. Rubber Reclaiming Co., Inc.	Pfd.	$0.50 accum.	Oct. 31	Oct. 27
Westinghouse Electric & Mfg. Co.	Com.	$0.75	Nov. 29	Nov. 8
Westinghouse Electric & Mfg. Co.	7% pt. Pfd.	$0.87½ q.	Nov. 29	Nov. 8
S. S. White Dental Mfg. Co.	Com.	$0.15 q.	Nov. 14	Oct. 30

*Plus 1/20-share common stock.

$2.07 each on 29,669 shares of Class A common stock, against $168,743, or $2.54 a share, on Class A stock last year.

Dow Chemical Co., Midland, Mich., and subsidiaries. Quarter ended August 31: net profit, $1,449,524, after deductions for interest, depreciation, federal income taxes, and other charges, equivalent, after dividend requirements on the preferred stock, to $1.33 each on 1,031,988 shares of common stock, against $838,703, or 81¢ each on 945,000 shares outstanding in the corresponding period last year. Dividends received in the quarter from associated units approximated the company's equity in their earnings.

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. Third quarter, 1939: consolidated net income, $22,926,709 after all charges, taxes, and reserves, equal, after dividends on the debenture and preferred stocks, to $1.91 a share on 11,050,474 common shares, against $12,350,713, or 95¢ a share on 11,047,195 shares, in the quarter ended September 30, 1938. Nine months ended September 30: net income, $62,798,244, or $5.19 a share on the common stock, against $31,288,318, or $2.31 a share on the common stock, in the corresponding period of 1938.

Electric Hose & Rubber Co., Wilmington, Del. Year ended August 31: net income, $91,820, equal to $7.20 each on 12,741 capital shares, against net loss of $16,755 in the previous year.

Faultless Rubber Co., Ashland, O. Year to June 30: net profit, $70,324, equal to $1.07 each on 65,450 shares of no-par capital stock, against $15,329, or 23¢ a share, in the previous year.

Flintkote Co., 50 W. 50th St., New York, N. Y., and subsidiaries. Year ended October 7: net income, $1,248,310, or $1.85 a share, against $620,046, or 92¢ a share in the corresponding period a year ago; net sales increased to $16,683,862 from $14,435,402.

General Electric Co., Schenectady, N. Y. First nine months, 1939: net profit, $25,022,631, against $17,548,256 in the same period last year, equal to 87¢ a common share, against 61¢ a share in the 1938 period; sales billed, $217,900,154, against $192,501,173 the year before; orders received, $248,581,851, against $188,756,958.

Hercules Powder Co., Wilmington, Del. First nine months of 1939: net income, $3,646,561, equal after preferred dividends to $2.47 a share on the common, against $1.20 in same 1938 period.

Hewitt Rubber Corp., Buffalo, N. Y. Nine months to September 30: net earnings, $184,596, equal to $1.09 a share, against $53,911, or 32¢ a share, last year. September quarter: net earnings, $103,543, or 61¢ a share, against $32,124, or 19¢ a share, in the corresponding period last year.

National Rubber Machinery Co., Akron, O. Nine months to September 30: Profit before federal income taxes, $105,966, against profit of $57,651 before taxes last year. Capital stock amounts to 154,000 shares.

Pharis Tire & Rubber Co., Newark, O. Nine months to July 31: net income, $320,736, equal to $1.46 each on 220,000 shares.

Thermoid Co., Trenton, N. J., and domestic subsidiary. September quarter: net profit, $75,555, equal to 9¢ each on 476,388 shares of $1 par common stock after quarterly dividend requirements on 39,956 shares of $3 convertible preferred stock, on which is accumulation of unpaid dividends, against $102,583, or 15¢ a common share, in the preceding quarter and $10,037, or 25¢ each on 39,956 preferred shares, in the third quarter of 1938. Nine months ended September 30: net profit, $244,288, equal to 32¢ a common share, against net loss of $69,595 last year. Year ended September 30: net income, $333,835, against net loss of $310,394 for year ended September 30, 1938.

From Our Columns

50 Years Ago—November, 1889

What is said to be the largest calender now in use in this country, is a portion of the equipment of Parker, Stearns & Sutton. (p. 35)

Four-roll calenders have long been in vogue, and even five, but a six-roll machine is something new. Such a calender is being built by the Birmingham Iron Works, for the new plant at Woonsocket. When running the monster machine will "friction" both sides of the cloth at once, thus doing double work. (p. 36)

On Assampink Creek, close by the Delaware and Raritan Canal, stands a solid stone building that is interesting, as being the first rubber mill started in Trenton. It is the plant of the Whitehead Brothers, and since '64 has been running continuously, oftentimes night and day on "mechanical goods." (p. 36)

25 Years Ago—November, 1914

The status of crude rubber as viewed by the belligerents has undergone several changes since the beginning of hostilities . . . the British government practically made all plantation rubber contraband by decreeing that no shipments from the Far East plantations under British control should be made anywhere except to London. This was followed a few days ago . . . by the prohibition of all exports of crude rubber from an English port. (p. 59)

Any American rubber manufacturer can take all the orders he can get for anything he produces that may be wanted by any of the belligerent countries. (Summary of a statement by U. S. State Department. (p. 60)

The war, which brought injury to business in this country generally, played particular havoc with the cotton industry. . . . It will stand out as one of the most notable achievements of the recent Congress that with so much sympathy for the southern situation it withstood the great temptation of shifting the planters' burden to the shoulders of the Government—which certainly would have been a very bad precedent in paternalism. (p. 60)

In the September issue . . . mention was made of the preliminary steps which had been taken by rubber importers in New York toward effecting an organization for their mutual benefit. . . . a meeting was called on October 23 at 80 Maiden Lane, New York, and the association was definitely organized, under the name of the Rubber Trade Association of New York. (p. 79)

Last year the world's production of rubber was 117,000 tons, while consumption represented a slightly larger quantity. (p. 106)

EUROPE

GREAT BRITAIN

Synthetics and Natural Rubber

Synthetics and their relation to the security of the plantation rubber industry are considered by H. P. Stevens.[1] Although research on synthetic rubbers has been pushed ahead for political purposes in certain countries, too much stress should not be laid on this aspect of the matter, the writer says, and points to the example of the United States to show that despite ample supplies and low prices of natural rubber, commercial firms with the necessary resources have found it worth while to develop synthetic rubbers. But as long as the present disparity in price between the natural and the synthetic products exists, the latter will continue to be used only for special purposes. Indeed, while these price conditions obtain, synthetic rubber, so far from displacing the natural material, may actually help to increase the consumption of the latter, for instance in the production of oil-resistant hose, i.e., a natural rubber hose with a synthetic lining.

The competitive strength of natural rubber due to the price advantage may be maintained and even increased by the reduction in costs of production to be expected from the exploitation of the budded areas. But over against this point must be set the possibility that improved methods and cheaper processes may also considerably lower the price of synthetic rubber.

It has been suggested to meet this threat by modifying the plantation product by some chemical process so as to obtain a material with the oil- and oxygen-resisting properties of the synthetic material. But Dr. Stevens shows that such modification would not solve the problem posed by the possibility of synthetics eventually being produced as cheaply or more cheaply than the natural product. The whole matter of the predominance of natural rubber, therefore, hinges on the question, at what price can synthetic rubber be made.

"If, therefore," he continues, "I were in control and had the future security of the plantation industry *vis à vis* the synthetic substitute to safeguard, I would not waste time and effort in a vain attempt to endow natural rubber with the properties it has not got and which it seems unlikely to acquire. I would rather concentrate all my resources on reducing the cost of producing and marketing natural rubber and in finding and developing new outlets for it."

He goes on to point out that outside of latex not a single radical change in production methods has been made since he visited the plantations before the war. He suggests that the process of coagulating latex and drying the coagulum could perhaps be made continuous if the material were thin enough to permit rapid coagulation and drying, and in a supplementary note refers to the fact that Buna latex is coagulated by a continuous process and is washed and dried in the form of a broad, thin ribbon.

[1] "Synthetics and Substitutes." *Bull. Rubber Growers' Assoc.*, July, 1939, pp. 401-405.

The War and the Rubber Industry

War trade restrictions were announced in the United Kingdom almost immediately after a state of war was declared. From September 5 on, import licences or exchange permits are required for all imports into the country. Among the products subject to import licences are manufactures wholly or mainly of rubber. Among the imports temporarily prohibited are sports, games, gymnastic and athletic appliances, apparatus and accessories, and toys and parts thereof.

Plans for various exhibitions have been given up. The Society of Motor Manufacturers & Traders, Ltd., announced that neither the Motor Exhibition scheduled for October nor the Commercial Motor Transport Exhibition for November could be held. Likewise the Chemists' Exhibition, set for September 18-22, was not held.

It is suggested that where windows have to be blacked out to meet the war-time black-out requirements, latex paints or a black rubber composition would be particularly satisfactory since if hostilities should end soon, it would be easy to remove, which would not be the case if oil-bound paint were used. The ease with which the black rubber paint can be removed also makes it valuable for temporary black-outs, for instance while a system permitting light to enter in the day-time was being developed and installed.

The Institution of the Rubber Industry intends to continue to serve the industry from its headquarters, 12 Whitehall, London, S.W.1, as long as it is practicable. Even if it should not prove possible to keep the planned program of meetings for the 1939-40 Session, it is hoped that sufficient support will be forthcoming to enable publications of the papers as communications in *I.R.I. Transactions*.

The British Rubber Publicity Association has opened a branch office at One Albert Mansions, Lansdowne Rd., Croyden, Surrey, to which all communications should be addressed.

GERMANY

Government Control

When Adolf Hitler took over the government of Germany in 1933, it was with a full recognition of the mistakes that had been made under the Kaiser and that had contributed to Germany's defeat, and he was determined that these would not be repeated under his rule. He decided that Germany was to be immediately and thoroughly prepared not only in military, but also economic matters. Hence the flood of orders to control industry that was loosed as soon as he came into power; hence the famous four-year plan. The new controlling measures forced importers and exporters, manufacturers, wholesalers and retailers to declare their stocks; imports, exports, methods of manufacture, and distribution and consumption were regulated; wage-scales and price limits fixed; and the free movement of workers was restricted.

The rubber industry was one of those that immediately came under the new regulations, and before long the government was in possession of all necessary facts regarding stocks of raw and manufactured goods, productive capacity, trade, etc. Now that war has come, the government has been in a position easily and quickly to take the next step, that is to confiscate all important materials, among which are rubber and chemicals, the latter including a number of those used in the rubber and synthetics industry. In most cases, at least as far as the rubber industry is concerned, there as yet has been no actual removal of goods from their owners, but rather they have been earmarked for possible government use; consequently the free sale and use of such goods have been prohibited. The goods must be properly taken care of and may not be sold, converted, or altered in any way without special permission. Unmounted tires form an exception, for these had to be surrendered, complete with inner tube, to specially indicated offices, before September 30; tires on vehicles that are not in actual use have had to be declared and must be surrendered on demand. Tire sales, of course, are rationed, and tires can only be bought by holders of special cards. As a result of all the sales restrictions, retailers in many fields are already suffering, and a special company has been formed which will extend credits at banking rates and on satisfactory security to deserving cases. In this way it is hoped also to lessen the risks run by banks.

Evaluating Fillers

Johannes Behre describes[1] a new method of examining rubber fillers to evaluate their activity in rubber, based on the adsorption capacity of powdered fillers with regard to Sangajol, as measured by means of a so-called Plastograph, a device which at the same

[1] *Kautschuk*, Sept., 1939, pp. 160-66.

time also permits the measurement of the strength of the plastic masses resulting from the adsorption. Sangajol, the most suitable wetting agent for the purpose, has been used for years in the varnish industry. Its chemical composition is similar to that of rubber, and it is always obtainable in uniform quality. With the aid of this substance 13 well-known rubber fillers were tested, and their behavior was found to correspond with the properties they have in rubber. No exact figures as to particle size are as yet obtainable, but apparatus is being developed which promises to provide a simple and accurate means of investigating particle size later on. Experiments are to be continued, particularly with regard to the action of dispersers.

Meetings Postponed

The general meeting of the Deutsche Kautschuk Gesellschaft, scheduled for September 14-16 in Weimar, has been postponed; also the national convention of German Chemists, originally set for Salzburg, September 18-23. New dates for both events are expected to be announced.

EUROPEAN NOTES

One of the results of the European conflict has been a wave of measures taken by various countries to restrict the foreign trade in a number of commodities including rubber and rubber manufactures. Consular reports indicate that so far export permits are required for rubber and/or rubber goods by Eire, Belgium, Latvia, Lithuania, Denmark, and the Netherlands. Latvia, however, is giving preferential treatment to imports of rubber.

Denmark

Denmark is already suffering as a result of the present situation. Some automobile assembly plants including those of American firms are closing, and it is estimated that from 50,000 to 60,000 employes connected with the automotive and gasoline trade may be thrown out of work. At the same time manufacturers of rubber goods and tire distributers are curtailing operations.

In the first half of 1939, Denmark's imports of raw rubber, considerably larger than in the preceding year, were 17,596 against 12,003 quintals. Imports of rubber manufactures included 13,627 quintals of automobile tires, against 10,503 quintals, 341 against 217 quintals cycle tires; 204 against 233 quintals footwear; and 5,847 against 4,527 quintals of unspecified rubber goods.

Italy

The Institute for the Study of Synthetic Rubber founded in Milan by Pirelli in conjunction with the I.R.I., started with a capital of 2,000,000 lire, later increased to 12,000,000 lire, and recently to 25,000,000 lire.

Reports from Italy state that *Hevea brasiliensis* was planted about one year ago in three different districts in Italian East Africa at altitudes of 600 and 1,300 meters. The year-old plants have now attained a height of 60 to 70 cms

Sweden

Official figures show that Sweden produced 6,870,000 pairs of rubber shoes in 1938 as compared with 7,668,000 pairs in 1937. The decrease in the output of these goods, however, was in a measure offset by the increase in production of tires for motor vehicles from 1,609 to 2,130 tons. The production of cycle tires declined from 1,832 to 1,790 tons.

Crude rubber imports almost doubled in the first half of 1939, as compared with the corresponding period of 1938, having been 6,080 tons against 3,343 tons, and increases in imports and exports of rubber manufactures further indicate that there was a revival of business activity during the 1939 period. Imports of automobile tires rose from 901 to 1,450 tons; surgical goods, from 158 to 244 tons. Exports included soles, packing, and the like, amounting to 57 against 40 tons; automobile tires, 28 against 15 tons; and footwear, 132 against 99 tons.

Polish Rubber Factory Destroyed

The General Tire & Rubber Co., Akron, O., recently announced that its Polish representative had reported that the factory at Poznan had been destroyed by Poles and that the Germans had taken over the new factory at Debica. With no financial investment, but under a profit-sharing arrangement, General was operating these two plants which were owned by Stomil, Inc., the government-controlled Polish rubber monopoly.

FAR EAST

MALAYA

Nutrient Elements of a Rubber Tree

Dr. A. W. J. Dyck in a recent article[1] discussing nutrient elements of rubber trees gives results of a chemical analysis of a normal mature tree, revealing that it weighs about 12,000 pounds, contains 34 pounds of nitrogen, 11 pounds of phosphoric acid, 39 pounds of potash, 58 pounds of lime, and 15 pounds of magnesia. This indicates the large quantities of nutrient elements held in the tree which may be lost if timber is removed from the land, for instance, during replanting operations. Analyses of the leaves and leaf-stalks show that on an acre-basis large amounts of the principal nutrient elements may regularly be lost to the tree during leaf-fall.

Plant Hormones

Dr. E. D. C. Baptist, who has conducted many preliminary tests on *Hevea* with a wide variety of chemical growth stimulants, discusses[2] the progress made in the use of plant hormones in general, and the results on *Hevea* are reported. So far tests show that suitable treatment with certain growth substances will markedly stimulate the rooting of cuttings from seedlings. But curiously enough, all tests with cuttings from buddings have failed up to the present. The use of solutions of suitable hormone substances may prove very valuable in transplanting budded stumps, as tests indicate that such treatment reduced deaths, hastened the appearance of roots and shoots, increased the length and weight of the shoot and the number and the weight of the roots. Treatment of the cambium with growth substance to stimulate bark renewal has so far given negative results, which is thought may be due to the high concentrations of plant hormone used or to the fact that lanolin was used as the "solvent." Highly significant increases in the amount of bark renewal were obtained by panel treatment with palm oil, which like other vegetable oils, contains free auxin (plant hormone) in physiological concentrations.

[1] "The Amounts and Distribution of Some of the Nutrient Elements in the Rubber Tree." *J. Rubber Research Institute Malaya*, July, 1939, pp. 6-13.

[2] "Plant Hormones." *Ibid.*, pp. 17-39.

INDO-CHINA

Crude rubber exports from Indo-China during the first half of 1939 amounted to 26,431 metric tons.

An examination of annual shipments from these parts since 1913 reveals the rapid development of direct business with consuming countries after 1930. Prior to this period, what rubber did not go to France from Indo-China was sent almost exclusively to Singapore for further distribution among foreign consumers. The trade via Singapore grew to such an extent that by 1930 the rubber shipped to that port exceeded the amount taken by France. During all this time direct shipments to other countries were insignificant. But after 1930 direct shipments to many countries, particularly Japan and America,

began to increase, largely at the expense of Singapore. The trend has continued, with America taking the lead, although the increased exports resulting from the improved conditions in the rubber industry after the introduction of restriction, also caused much more rubber to be sent via Singapore again.

Figures for 1938 show that of the total exports amounting to 59,458 metric tons, 10,500 metric tons went to Singapore, 17,495 tons to France, and 22,504 metric tons went to the United States.

CEYLON

According to the Rubber Controller of Ceylon, net exports of rubber for 1938 came to 49,282 tons, an excess of 7,145 tons, including the carry-over of 3,238 tons. The basic quota was 82,500 tons.

During the first period of the current restriction scheme permits were issued for replanting 26,016 acres, of which only 16,934 acres were actually replanted, with budded material used in all cases. As the budded area prior to 1934 was 5,076 acres, the total area under budded area in Ceylon now is 22,011 acres. In 1938 the yield of 133,175 budded trees on 66 estates was assessed at a total of 650,799 pounds.

The terms of the revised international agreement permits Ceylon to plant to 30,260 acres of new rubber during 1939 and 1940. Some difficulty was met in allocating planting permits, but finally it was decided to reserve 20,000 acres for middle-class Ceylonese and peasants.

The planted area in May, 1934, totaled 604,111 acres, of which 349,644 acres were owned by large estates, 123,980 acres by small estates, and 130,487 acres by small-holders. During the period June, 1934-December, 1938, 300 acres of new rubber were planted for experimental purposes and the like.

Exports of crude rubber from Ceylon during the first half of 1939 came to 24,867 long tons.

G. K. Thornhill, former surveyor-general of Ceylon, invited to Ceylon by the Ministry of Labor, Industry and Commerce to assist in promoting a scheme for local production of rubber goods on a large scale, has arrived to make necessary investigations.

The Board of Management of the Rubber Research Scheme intends to modify the rubber research cess by levying it according to a sliding scale. This move has become necessary to assure a regular income of 225,000 rupees, which is required if desirable expansions are to be made possible. At present the income fluctuates from quarter to quarter with changes in the export quota, thus hampering new work of the organization.

NETHERLAND INDIA

Exports and Quotas

The basic quota of Netherland India, which rose from 352,000 to 540,000 long tons in the first restriction period, was again raised and will be from 631,500 to 651,000 long tons in the second period, by which Netherland India is placed on practically an equal level with British Malaya. The division of the quota among estates and natives caused some difficulty, but the arrangement finally adopted, allowed estates a small advantage over natives.

The exports of crude rubber in 1938 showed a substantial decrease over those of the preceding year owing to more severe restriction of exports. The following table gives details in long tons:

Year	Java	East Coast Sumatra	Rest of Sumatra	Borneo	Celebes	Total
1934	88,820	119,188	103,134	73,875	474	385,491
1935	58,454	85,554	74,245	66,840	444	285,537
1936	62,396	96,679	84,328	70,661	531	314,595
1937	85,421	140,790	127,724	63,902	768	438,605
1938	58,421	96,111	87,445	60,300	605	302,882

The share of the estates in the rubber exports of 1938 came to 148,500 long tons against 213,500 long tons in 1937, chiefly as a result of the lower shipments to the United States.

Attention is called to the growing trend for rubber to be shipped direct from the Outer Provinces to foreign destinations, intead of going to Singapore first. This is also the case with regard to native remilled rubber. Incidentally, it is noted that various foreign countries are showing a growing interest in remilled blankets and other types of native rubber.

Exports of crude rubber from Netherland India in the first half of 1939 totaled 165,519 tons, against total permissible exports of 160,406 tons, creating an excess of 5,113 tons for this period. In the first quarter of 1939 estates had underexported 3,491 tons and natives had overexported 6,666 tons; in the second quarter the position was reversed, estates shipped 2,533 tons more and natives 595 tons less than permissible.

Restriction and Prosperity

The Netherland India Rubber Trade Association at Batavia in its annual report for 1938 finds that the results of the first period of the current restriction scheme can lead to but one conclusion, that the scheme has had a favorable effect on the prosperity of a very large part of Netherland India. There was a considerable increase in earnings from rubber which was not only due to higher prices—although these were well above the abnormally low prices of the three years immediately preceding restriction—but to a great extent also to the increased exports.

An analysis of results of 71 rubber estates for the year 1929 and the years 1931-1937 inclusive, made by Dr. Sternheim for De Kroniek, is cited to show the improved condition of rubber companies as a result of restriction. While 26 of the 71 companies were still paying dividends in 1929, only two were able to do so in 1931 and 1932; six in 1933; 13 in 1934; 12 in 1935; but 24 in 1936, and 54 in 1937.

The curious fact is stressed that restricted exports were actually higher than those in the pre-restriction years. Even in 1929, when the price was still about 54 guilder cents per kilo, exports were below the lowest in any of the restriction years. The decreased exports in 1931 and 1932 were, of course, due to the depressed conditions prevailing at the time. It is emphasized that the existence of a regulation that restricted production and export was an important factor in effecting a more lasting improvement in the rubber position, which would not otherwise have been possible.

Despite various difficulties, especially in connection with native rubber, the necessary restriction measures could be carried out in a satisfactory manner. The much-maligned special export duty on native rubber, it is pointed out, had its good side. For one thing, the decision to use most of the proceeds of this duty to benefit the natives, as for instance by an improved health service, increased educational facilities, and more especially by the building of new roads, bridges and the like, is helping to develop the Outer Provinces and to promote the prosperity and health of the native population.

Local Manufacture of Rubber Goods

Local manufacture of rubber goods showed a further increase during 1938, reflected in the heavier consumption of raw rubber. The latter was 2,306 long tons in 1938, against 2,043 tons in 1937 and 1,285 tons in 1936. This growth was accompanied by a continued decrease in tire imports, which in 1938, however, was confined chiefly to imports of cycle tires and tubes. The following table illustrates this development:

	1936	1937	1938
Automobile tire covers ....*no.*	62,000	53,000	53,000
Automobile inner tubes	27,000	14,000	28,000
Cycle tire covers.	1,919,000	1,412,000	644,000
Cycle inner tubes.	1,534,000	1,454,000	346,000
Total	3,542,000	2,933,000	1,071,000

In 1935, a total of 5,746,000 tires and tubes of all kinds were imported. Exports of rubber goods, chiefly tires and tubes, were 153 tons in 1937 and rose to 481 tons in 1938.

Editor's Book Table

NEW PUBLICATIONS

"Monsanto Magazine." September, 1939. Monsanto Chemical Co., St. Louis, Mo. 40 pages. Charles Belknap, Monsanto executive, attacks the idea that war is desired by American industrialists in his article, "War Means Years of Blackouts," in this issue of the *Monsanto Magazine.* Mr. Belknap supports his argument with nine reasons why American chemical manufacturers oppose United States participation in war. Continuing the subject, E. J. Cunningham, in an article on "War Profits Didn't Stick," debunks the conception of lasting profits and prosperity from war-time business. Among the other articles in this issue is one on foamed latex—its production, properties, and applications.

"Baldwin-Southwark." Third Quarter, 1939. Baldwin-Southwark Corp., Philadelphia, Pa. 24 pages. Featured in this issue of *Baldwin-Southwark* are articles on the Diesel-steam combination for heat and power requirements, abrasive wheels, the development of the hydraulic press, fatigue tests for metals, and flood control. The historical article on the hydraulic press points out the outstanding developments since its inception in 1795.

"News about du Pont Rubber Chemicals." E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. This news letter of September 29 points out that because of freedom from odor, the G types of Neoprene are opening up new applications that were closed to earlier types. With the news letter is a 20-page report on "Neoprene Types G and GW," by N. L. Catton and D. F. Fraser, which, after pointing out the relation of the various G types of Neoprene, takes up successively: modifying agents such as magnesium oxide, zinc oxide, antioxidants, sulphur, and rosin; softeners; fillers and reenforcing materials; processing; and compounding for specific properties.

"Goodrich Oil Hose for Cargo Handling." B. F. Goodrich Co., Akron, O. 4 pages. Described in this catalog section is the firm's line of combination suction and discharge oil hose which is used in refineries and distributing terminals, on oil tankers and barges, for loading and unloading oil cargoes, for conducting oil and gasoline from sea lines to tankers, and for other services requiring flexible connections of this type. Approximate data are presented on each type of hose, such as number of plies, weight, and outside diameter. A discussion on oil hose fittings is also included.

"Modern Plastics Catalog-Directory." *Modern Plastics,* 122 E. 42nd St., New York, N. Y. 454 pages. Price $2. The October issue of *Modern Plastics,* bound in a laminated plastic material, appears for the fourth consecutive year as a combination handbook, catalog, and directory for the plastics industry. Keeping pace with the fast-moving developments in this field, this reference work provides a vast amount of information on the materials, methods, and equipment used in the manufacture of plastics. The bulk of the text material is presented in 50 authoritative articles. One of these which deals with rubber-like materials contains a table of comparative physical properties of natural rubber, synthetic rubbers, reclaim, factice, gutta percha, and similar materials. Other sections are devoted to product development, bibliography, and nomenclature. The plastics properties chart which appeared last year has been continued—revised and brought up to date. A comprehensive buyers' and trade name directory with an alphabetical list of manufacturers and addresses completes the book.

"Automobile Facts and Figures." Twenty-first edition, 1939. Automobile Manufacturers Association, Inc., 366 Madison Ave., New York, N. Y. 96 pages. This annual statistical review of the automobile industry for the calendar year 1938 covers sales, production, registrations, taxes, employment, and other vital statistics relating to this industry. According to this report, the automobile was responsible for the consumption of 329,090 long tons of rubber, or 80% of the total consumed in this country during 1938.

"Belting Biographies." United States Rubber Co., Mechanical Goods Division, 1790 Broadway, New York, N. Y. 36 pages. In this catalog each of the company's belting products is introduced by an illustrated discussion of a typical installation. The booklet also contains much technical information—data on belt selection, installation, operating speed, pulley size, tension, carrying capacity, etc.

"Manual of Naugatuck Chemicals." Naugatuck Chemical Division of United States Rubber Co., 1790 Broadway, New York, N. Y. Concise information on the firm's chemicals for the rubber industry is presented in ten bulletins contained in a handy loose-leaf binder. Six bulletins deal with accelerators, three with antioxidants, and one with the anti-scorch material, E-S-E-N. A complete list of products with current prices is included. Subsequent bulletins issued may be inserted in the binder.

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Patents and Trade Marks

MACHINERY

United States

2,171,723. **Apparatus to Coat Articles.** J. H. Flink, assignor to Hood Rubber Co., both of Watertown, Mass.
2,171,949. **Triturating Machine.** M. Roca and E. Guix, both of Barcelona, Spain.
2,172,005. **Device to Rubber Cover Rolls.** F. S. Bowker, Woonsocket, R. I.
2,172,018. **Thread Making Device.** W. M. Spencer, Allentown, Pa., assignor, by mesne assignments, to Filatex Corp., New York, N. Y.
2,172,111. **Plastic Material Molding Apparatus.** E. L. Schick, Cuyahoga Falls, O., assignor to B. F. Goodrich Co., New York, N. Y.
2,173,256. **Filter.** H. F. Jordan, Nutley, N. J., assignor, by mesne assignments, to United States Rubber Co., New York, N. Y.
2,173,343. **Dress Shield Form.** A. N. Spänel, Rochester, N. Y.
2,173,588. **Vulcanizing Mold Cooler.** M. Mahler, assignor to H. Mahler, trading as "Harry's" Tire Shop," both of Newark, N. J.
2,173,738. **Tire Balancer.** W. R. Urquhart and E. G. Templeton, both of Akron, O., assignors to Wingfoot Corp., Wilmington, Del.
2,173,195. **Tire Spreader and Inspection Machine.** L. P. Fisher, assignor to Bowes Seal Fast Corp., both of Indianapolis, Ind.
2,174,188. **Tire Molding Apparatus.** J. C. Heintz, Lakewood, O.
2,174,189. **Retreading Vulcanizer.** J. C. Heintz, Lakewood, O.
2,174,590. **Tire Retreading Mold.** J. C. Meier, Stockton, Calif.
2,174,688. **Cord Stretcher.** L. M. Cotchett, Hingham, Mass., assignor, by mesne assignments, to United States Rubber Co., New York, N. Y.
2,174,874. **Tire Treater.** W. F. Errig, Jenkintown, Pa., and E. S. De Hart, Collingswood, N. J., assignors to Peco Mfg. Corp., Philadelphia, Pa.
2,174,949. **Knitting Machine.** R. F. Raven, Beeston, and H. A. Raynor, Wollaton Park, Nottingham, England.
2,175,099. **Conductor Producing Apparatus.** C. W. Abbott, Larchmont, N. Y.

Dominion of Canada

383,990. **Cord Stretcher.** Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of C. J. Killette, Hogansville, Ga., U. S. A.
384,123. **Tube Making Device.** Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of R. Patrick, Indianapolis, Ind., U. S. A.
384,127. **Thread Manufacturing Machine.** Easthampton Rubber Thread Co., assignee of K. R. Shaw, both of Easthampton, Mass., U. S. A.
384,268. **Tire Making Apparatus.** Dunlop Rubber Co., Ltd., London, and Francis Shaw & Co., Ltd., Manchester, assignees of H. Willshaw and F. G. Broadbent, both of Birmingham, all in England.

United Kingdom

504,939. **Vulcanizer.** A. L. Wallace.
505,162 and 505,163. **Vulcanizer.** Compagnie Generale D'Electricite.
505,389. **Latex Heater.** R. A. Dufour and H. A. Leduc.
505,393. **Conveyers for Tire Building.** Wingfoot Corp.
505,822. **Tire Groover.** E. H. Stackhouse.
507,477. **Tire Tester.** Dunlop Rubber Co., Ltd., J. I. S. Williams, and F. G. Broadbent.
507,513. **Knitting Machine.** United States Rubber Products, Inc.

Germany

680,937. **Pressure Mold.** Semperit Oesterreichisch-Amerikanische Gummiwerke A.G., Vienna.
680,988. **Coupling.** Getefo, Gesellschaft fur technischen Fortschritt m.b.H., Berlin.
681,226. **Device to Cover Rubber Thread.** T. Hahn, Wuppertal-Barmen.

PROCESS

United States

2,171,544. **Masking Strip.** J. O. Doty and P. C. Orcutt, Indianapolis, Ind., assignors to Minnesota Mining & Mfg. Co., St. Paul, Minn.
2,171,552. **Rubber Article Processing.** E. A. Hauser, Cambridge, Mass., assignor to "Semperit" Oesterreichisch-Amerikanische Gummiwerke Aktiengesellschaft, Vienna, Germany.
2,171,607. **Golf Ball.** C. R. Sibley, Marblehead, assignor to Sibley-Pym Corp., Lynn, both in Mass.
2,171,764. **Seamless Tubing.** R. A. Ramsdell, Syosset, N. Y., assignor, by mesne assignments, to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.
2,171,901. **Vulcanizing Rubber.** N. R. Wilson, Belleville, and A. J. Lang, Jersey City, assignors to Rare Metal Products Co., Belleville, both in N. J.
2,172,084. **Food Decoration.** E. D. Kowal, assignor of one-half to J. Kowal and one-half to W. S. Rench, all of San Diego, Calif.
2,172,251. **Coating Knit Articles.** L. G. Copeman, assignor to Copeman Laboratories, both of Flint, Mich.
2,172,400. **Articles from Aqueous Rubber Dispersions.** S. B. Neiley, Winchester, assignor to Dewey & Almy Chemical Co., North Cambridge, both in Mass.
2,172,466. **Mold.** (Latex.) J. Edwardes and S. R. Du Brie, both of Detroit, Mich.
2,172,497. **Cord for Tires, Belts, Etc.** C. C. Cadden, Akron, O., assignor to B. F. Goodrich Co., New York, N. Y.
2,172,921. **Loom Picker.** H. Bacon, Warren, O.
2,173,241, 2,173,242, 2,173,243, and 2,173,244. **Treating Fibrous Material.** (Latex.) H. A. Young, Westfield, N. J., assignor, by mesne assignments, to United States Rubber Co., New York, N. Y.
2,173,734. **Glove.** (Latex.) A. E. Sidnell, Akron, assignor to Seiberling Latex Products Co., Barberton, both in O.
2,174,899. **Ornamental Glass.** A. Selsky, Brooklyn, N. Y.
2,174,943. **Sole.** (Latex.) C. R. Keiser, Dayton, and T. R. Rike, West Alexandria, both in O., assignors, by mesne assignments, to Rainbow Rubber Co., Butler, Pa.
2,175,052. **Dispenser Cap.** A. W. Bull, Grosse Pointe, and C. M. Sloman and C. M. Grafton, both of Detroit, Mich., assignors, by mesne assignments, to United States Rubber Co., New York, N. Y.

Dominion of Canada

383,652. **Fabric.** P. Schönfeld, Chemnitz, Germany.
383,825. **Wire Coating.** Candy & Co., Inc., Chicago, assignee of A. T. Candy, Jr., Oak Park, both in Ill., U. S. A.
384,141. **Coating Fabrics.** (Latex.) International Latex Processes, Ltd., St. Peter's Port, Channel Islands, assignee of A. G. Emery, New Haven, Conn., U. S. A.
384,168. **Hot Gassing Process.** Rubatex Products, Inc., New York, N. Y., assignee of L. Cooper, Monson, Mass., both in the U. S. A.

United Kingdom

504,667. **Relief Ornaments.** F. C. Jones and Reliance Rubber Co., Ltd.
505,104. **Dipped Goods.** (Synthetic Rubber.) H. Dreyfus.
505,156. **Reclaiming Rubber.** Soc. Italiana Pirelli.
505,229. **Impregnating Driving Belts.** (Latex.) J. M. Marti.
505,450. **Thread.** (Synthetic Rubber.) G. W. Johnson, (I. G. Farbenindustrie A.G.).
505,502. **Rubber.** Rubber-Latex-Poeder-Cie, N. V. and S. H. Bertram.
505,726. **Gas Mask Molding.** International Latex Processes, Ltd.
505,942. **Compound Sheet Material.** W. Kubica.
505,959. **Inner Tubes.** United States Rubber Products, Inc.
506,076. **Sheet Material.** Walsall Lithographic Co., Ltd., and S. G. Gosling.
506,079. **Cable Joint.** J. Beresford & Son, Ltd., and S. A. Smith.
506,205. **Golf Ball.** Dunlop Rubber Co., Ltd., and D. F. Twiss.
506,364. **Shoes.** Soc. Industrielle D'Auteuil Soc. Anon.
506,642. **Thread.** Dognin Soc. Anon.
506,890. **Expansion Joints.** (Latex.) International Latex Processes, Ltd.
507,493. **Treating Latex.** (Latex.) Dunlop Rubber Co., Ltd., E. W. Madge, and E. A. Murphy.
507,501. **Synthetic Rubber Thermostat Elements.** Vernay Patents Co.

CHEMICAL

United States

2,172,463. **Stabilizer.** (Latex.) E. V. Anderson, Naugatuck, Conn., assignor, by mesne assignments, to United States Rubber Co., New York, N. Y.
2,173,711. **Antioxidant.** A. M. Clifford, Stow, O., assignor to Wingfoot Corp., Wilmington, Del.
2,173,731. **Accelerator.** W. Scott, Akron, O., assignor to Wingfoot Corp., Wilmington, Del.
2,173,732. **Accelerator.** L. B. Sebrell, Silver Lake, and A. M. Clifford, Stow, assignors to Wingfoot Corp., Akron, all in O.
2,174,280. **Butadiene from Butanediol 1,3.** V. E. Wellman, Silver Lake, O., assignor to B. F. Goodrich Co., New York, N. Y.
2,174,545. **Polyvinyl Halide Compositions Stabilized with Water Glass.** C. H. Alexander, Cuyahoga Falls, O., assignor to B. F. Goodrich Co., New York, N. Y.
2,174,673. **Dispersions of Rubber Hydrochloride.** H. A. Winkelmann, assignor to Marbon Corp., both of Chicago, Ill.
2,174,674. **Rubber Hydrochloride Composition.** H. A. Winkelmann, assignor to Marbon Corp., both of Chicago, Ill.
2,175,048. **Plasticized Polyvinyl Chloride Composition.** C. H. Alexander, Cuyahoga Falls, O., assignor to B. F. Goodrich Co., New York, N. Y.
2,175,049. **Polyvinyl Halide Compositions.** C. H. Alexander, Cuyahoga Falls, O., assignor to B. F. Goodrich Co., New York, N. Y.

Dominion of Canada

383,782. **Silicate-Chlorinated Rubber.** N. Pal, London, England.
383,888. **Mercapto Aryl Thiazole.** Wingfoot Corp., Wilmington, Del., assignee of A. M. Clifford, Stow, O., both in the U. S. A.
384,124. **Materials for Raising Surface Tension of Latex.** (Latex.) Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of W. A. Gibbons, Montclair, and J. McGavack, Leonia Township, co-inventors, both in N. J., U. S. A.

United Kingdom

505,062. **Rubber-Shellac Compositions.** L. S. E. Ellis, (W. Zinsser & Co., Inc.).
505,113. **Antioxidants.** W. Baird, R. F. Goldstein, M. Jones, and Imperial Chemical Industries, Ltd.
505,259. **Adhesive.** (Synthetic Rubber.) United Shoe Machinery Corp.
505,475. **Preservative.** (Latex.) United States Rubber Products, Inc.
505,517. **Plastic Compositions.** Soc. of Chemical Industry in Basle.
505,625. **Softening Agent.** (Synthetic Rubber.) P. Quinn.
505,709. **Zinc Oxide Content Clay Particles.** L. Mellersh-Jackson, (S. C. Lyons).
505,750. **Stabilizer.** (Latex.) I. Traube, F. W. Wren, and J. H. Platford.
505,759. **Hydrohalogenated Rubber.** Wingfoot Corp.
505,770. **Neutralized Rubber Hydrohalide Solutions.** Wingfoot Corp.
505,781. **Rubber Chloride Coating Compositions.** J. W. Raynolds.
505,794. **Leather Substitute.** (Latex and Synthetic Rubber.) W., O., H., and R. Freudenberg and C. L. Nottebohm.
505,801. **Artificial Leather.** (Latex.) W., H., O., and R. Freudenberg.
506,038. **Butadiene from Tetrahydrofurane.** (Synthetic Rubber.) G. W. Johnson, (I. G. Farbenindustrie A.G.).
506,142. **Tire Composition.** United States Rubber Products, Inc.
506,296. **Accelerator.** Wingfoot Corp.
506,427. **Rubber-Like Products from Isobutylene Polymers.** Standard Oil Development Co.
506,565 and 506,566. **Antioxidant.** United States Rubber Products, Inc.
506,926. **Rubber-Like Polymers from Isobutylene and N-Vinyl Carbazole.** C. W. Johnson, (I. G. Farbenindustrie A.G.).
506,931. **Surface Finishing Emulsions.** Dunlop Rubber Co., Ltd., A. Niven, E. A. Murphy, and E. W. Madge.
507,323. **Insulating Material.** Standard Telephones & Cables, Ltd., T. R. Scott, and M. C. Field.
507,327. **Adhesive.** (Latex.) Wingfoot Corp.
507,339. **Rubber Composition.** A. H. Stevens, (Phillips Petroleum Co.).
507,847. **Butadiene from Dimethyl or Ethyl Acetylene.** G. W. Johnson, (I. G. Farbenindustrie A.G.).

GENERAL

United States

21,213. (Reissue). **Windshield Heater.** M. Zaiger, Swampscott, Mass.
2,171,591. **Brush.** H. D. Minich, North Tarrytown, N. Y.
2,171,654. **Shoe Protector.** R. and E. C. Hinchliff, assignors to Burson Knitting Co., all of Rockford, Ill.
2,171,676. **Bait Kit.** F. P. Wallace, Detroit, Mich.
2,171,708. **Package for Plastic Material.** (Latex.) C. A. Nelson, Milford, Del.
2,171,728. **Flexible Beading.** B. J. Lee and H. Gora, Bridgeport, Conn., assignors to Jenkins Bros., New York, N. Y.

2,171,774. **Vibration Dampening Device.** J. C. H. Wendes, Naugatuck, Conn., assignor, by mesne assignments, to United States Rubber Co., New York, N. Y.
2,171,845. **Washing Machine.** P. Cureton, Vallejo, Calif.
2,171,875. **Suction Cup Bracket.** O. W. Holden, assignor to Knickerbocker Rubber Co., both of Chicago, Ill.
2,171,913. **Girdle.** C. Bullinger, Riverside, assignor to A. Stein & Co., Chicago, both in Ill.
2,172,079. **Valve.** A. O. Boehm, Chicago, assignor to Perfection Gear Co., Harvey, both in Ill.
2,172,125. **Plug.** W. W. Hamill, Forest Lane, Chigwell, England.
2,172,182. **Ice Cream Apparatus.** N. M. Thomas, Brooklyn, assignor to Joe Lowe Corp., New York, both in N. Y.
2,172,210. **Girdle.** B. Lewis, Maplewood, N. J., assignor to Lewel Mfg. Co., Inc., New York, N. Y.
2,172,407. **Pad for Sanders, Etc.** B. B. Ramey, Towson, Md., assignor to Black & Decker Mfg. Co., a corporation of Md.
2,172,425. **Ball.** C. A. Webb, assignor to C. B. Webb Co., both of Lebanon, Pa., a copartnership composed of C. B. and G. I. Webb.
2,172,435. **Rotary Brush.** G. R. Churchill, Quincy, Mass.
2,172,444. **Filing Cabinet Folder.** E. W. Larson, Downers Grove, and C. C. McCain, Glen Ellyn, both in Ill., assignors to Western Electric Co., Inc., New York, N. Y.
2,172,455. **Bandage Package.** M. Samuel, Cologne, Germany.
2,172,458. **Door Gasket.** A. C. Shuart, Rockford, Ill., assignor to Servel, Inc., New York, N. Y.
2,172,460. **Electromagnetic Device.** C. F. Warrick, Detroit, assignor to Bender-Warrick Corp., Birmingham, both in Mich.
2,172,501. **Mouth Bit.** I. B. Dalziel, Woodside, Calif.
2,172,573. **Eyeshield.** I. D. Blumenthal, Charlotte, N. C.
2,172,575. **Suction Device.** M. H. Caulfield, Llanerch, Pa.
2,172,585. **Steering Wheel Protector.** A. J. Iller, assignor of one-half to H. G. Holder, both of La Jolla, Calif.
2,172,641. **Wheel and Springing Element.** E. H. Piron, assignor to Transit Research Corp., both of New York, N. Y.
2,172,675. **Film Reel Spacer.** N. Goldberg, Denver, Colo.
2,172,849. **Tie Clasp.** L. B. Peters, Cedar Falls, Iowa.
2,172,990. **Skid Rim.** F. Sawer, Ludell, Kan.
2,172,998. **Gum Massager.** H. Grout and Z. Lemley, both of Denver, Colo.; said Lemley assignor to said Grout.
2,173,065. **Inner Tube.** W. J. Lee, Cuyahoga Falls, O., assignor to Wingfoot Corp., Wilmington, Del.
2,173,097. **Paper Carrier Sheet for Tacky Rubber.** G. W. Coggeshall, Yarmouth, Me., assignor to S. D. Warren Co., Boston, Mass.
2,173,250. **Anti-Friction Bearing.** E. F. Fay, assignor to Norma-Hoffman Bearings Corp., both of Stamford, Conn.
2,173,288. **Ice Bag.** J. Shapiro, Brooklyn, N. Y.
2,173,336. **Slicer.** J. J. Lamere, Wollaston, and F. A. Perry, Malden, assignors, by mesne assignments, to General Seafoods Corp., Boston, all in Mass.
2,173,343. **Dress Shield Form.** A. N. Spániel, Rochester, N. Y.
2,173,359. **Hose.** A. L. Freedlander, assignor to Dayton Rubber Mfg. Co., both of Dayton, O.
2,173,388. **Swimming Support.** W. Barcroft, London, England.
2,173,468. **Garment Support.** J. S. Bennett, Hammondsport, N. Y.
2,173,558. **Heel.** S. H. Lindblom, assignor to E. V. W. H. Von Geijer, both of Stockholm, Sweden.
2,173,565. **Radio Frequency Transmission Line.** H. O. Peterson, Riverhead, N. Y., assignor to Radio Corporation of America, a corporation of Del.
2,173,619. **Tire Inflater and Tester.** A. R. Ames, assignor to Ames Supply Co., both of Chicago, Ill.
2,173,668. **Wire Connecting Device.** D. F. Smith, Los Angeles, Calif.
2,173,736. **Battery-Servicing Unit.** J. C. Thomas, Akron, O., assignor to Wingfoot Corp., Wilmington, Del.
2,173,744. **Plastic Packing.** F. E. Payne, Glencoe, assignor to Crane Packing Co., Chicago, both in Ill.
2,173,779. **Pouring Spout.** P. L. Francois, East Orange, N. J.
2,173,803. **Bottle Capper.** T. R. Gammeter, assignor of one-half to S. G. Gammeter, both of Akron, O.
2,173,804. **Rubber Rolling Hoop.** W. T. Hanrahan, New York, N. Y., assignor to Petroleum Iron Works Company of O., Sharon, Pa.
2,173,864. **Platen.** J. Q. Sherman and A. W. Metzner, both of Dayton, O.; said Metzner assignor to said Sherman.
2,173,890. **Ventilator.** T. H. Tuttle, assignor to Checker Cab Mfg. Corp., both of Kalamazoo, Mich.
2,173,972. **Tie Band.** (Latex.) J. D. Lane, Boston, assignor to R. H. Wilbur, Melrose, both in Mass.
2,173,976. **Elastic Fabric.** J. V. Moore, assignor to Moore Fabric Co., both of Pawtucket, R. I.
2,173,989. **Tie Band.** (Latex.) R. H. Wilbur, Melrose, Mass.
2,174,049. **Film Clip.** G. Werner, Peking, China, assignor to G. Von Hessert, New York, N. Y.
2,174,081. **Distributer Head Assembly.** J. T. Fitzsimmons, Anderson, Ind., assignor to General Motors Corp., Detroit, Mich.
2,174,298. **Stencil.** H. L. Whisner, Clarion, Pa., assignor to Owens-Illinois Glass Co., a corporation of O.
2,174,361. **Nipple.** B. D. Condon, Spokane, Wash.
2,174,385. **Surfacing Apparatus.** L. Holmes, Medina, O., assignor to B. F. Goodrich Co., New York, N. Y.
2,174,455. **Ice Bag.** J. D. Bates, Springfield, Mass.
2,174,530. **Window Guide and Cushion.** J. S. Reid, Shaker Heights, assignor, by mesne assignments, to Standard Products Co., Cleveland, both in O.
2,174,693. **Arm Construction.** J. W. Early, assignor to Borg-Warner Corp., Chicago, Ill.
2,174,716. **Amusement Device.** H. F. Bethell, Norwalk, Conn.
2,174,724. **Brake.** W. H. Hunter, Akron, O., assignor to B. F. Goodrich Co., New York, N. Y.
2,174,752. **Heel Insert.** L. A. Laursen, Copley, O.
2,174,881. **Brassiere.** H. Holister, assignor to E. Miller, both of Berlin, Germany.
2,174,966. **Tie Lining.** C. E. Campagnoli, Palisade, N. J., assignor to G. J. M. Textile Corp., New York, N. Y.
2,175,011. **Kneeler.** D. R. Archer, Brooklyn, N. Y., assignor to Archer Rubber Products Co., a corporation of N. Y.
2,175,068. **Fire Extinguisher.** T. G. Slack, Boylston, Mass.
2,175,118. **Spring Securing Means.** C. F. Hirshfeld, Detroit, Mich., assignor to Transit Research Corp., New York, N. Y.
2,175,128. **Ball.** M. B. Reach, Springfield, Mass.
2,175,157. **Cleaning Device.** A. A. Nu-Dell, assignor to Nu-Dell Mfg. Co., Inc., both of Chicago, Ill.

Dominion of Canada

383,628. **Stocking Protector.** I. Klien, Toronto, Ont.
383,637. **Hair Net.** L. Mayer, Chicago, Ill., U. S. A.
383,649. **Garment Belting.** L. Rigg, Cheadle, Chester, England.
383,651. **Scraper.** M. E. Samuel, Martin's Ferry, U. S. A.
383,653. **Window Sash.** W. Speare, Toronto, Ont.
383,781. **Horseshoe Protector Securing Means.** O. Mioen, Stockholm, Sweden.
383,834. **Acetylene Generator.** Dominion Oxygen Co., Ltd., Toronto, Ont., assignee of M. P. DeMotte, Indianapolis, Ind., U. S. A.
383,835. **Tire.** Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of A. A. Thomas, New York, N. Y., U. S. A.
383,854. **Hydrometer.** Kimble Glass Co., assignee of S. S. McClure, both of Vineland, N. J., U. S. A.
383,878. **Spring Device.** Transit Research Corp., assignee of E. H. Piron, both of New York, N. Y., U. S. A.
383,881 and 383,883. **Railway Car Cushioning Mechanism.** Waugh Equipment Co., New York, assignee of L. M. Clark, Snyder, both in N. Y., U. S. A.
383,928. **Corset.** M. L. Jacks, London, England.
383,989. **Transmission Belt.** (Synthetic Rubber.) Dayton Rubber Mfg. Co., assignee of A. L. Freedlander, both of Dayton, O., U. S. A.
384,008. **Battery.** Maxolite Holdings, Ltd., London, assignee of F. Maccallum, Birmingham, both in England.
384,031. **Door Sealing Strip.** Standard Products Co., Cleveland, assignee of J. S. Reid, Shaker Heights, both in O., U. S. A.
384,075. **Collapsible Boat.** F. W. Maves, Welland, Ont.
384,082 and 384,083. **Elastic Stocking Welt.** C. W. Seidel, Chicago, Ill., U. S. A.
384,122. **Racket String.** Dominion Rubber Co., Ltd., Montreal, P. Q., assignee of N. G. Madge and F. D. Chittenden, co-inventors, both of Providence, R. I., U. S. A.
384,136. **Hydraulic Power Apparatus.** India-Rubber, Gutta Percha & Telegraph Works Co., Ltd., assignee of F. J. Tarris and D. Webb, co-inventors, all of London, England.
384,137. **Sponge Rubber Product.** Industrial Process Corp., assignee of H. R. Minor, both of Dayton, O., U. S. A.
384,157. **Abrasive Wheel.** Norton Co., assignee of B. Sanford, both of Worcester, Mass., U. S. A.
384,158. **Grinding Wheel.** Norton Co., assignee of A. T. Sohlstrom, both of Worcester, Mass., U. S. A.
384,236. **Metal Panel.** Edward G. Budd Mfg. Co., assignee of J. Ledwinka, both of Philadelphia, Pa., U. S. A.
384,239. **Socket.** Canadian General Electric Co., Ltd., assignee of L. J. Clayton, both of Toronto, Ont.
384,240. **Socket.** Canadian General Electric Co., Ltd., assignee of A. K. Whyte, both of Toronto, Ont.
384,280. **Tire.** Firestone Tire & Rubber Co. of Canada, Ltd., Hamilton, Ont., assignee of J. E. Hale, Akron, O., U. S. A.
384,281. **Coupling.** Firestone Tire & Rubber Co. of Canada, Ltd., Hamilton, Ont., assignee of E. F. Riesing, Akron, O., U. S. A.
384,282. **Coupling.** Firestone Tire & Rubber Co. of Canada, Ltd., Hamilton, Ont., assignee of C. Saurer, Akron, O., U. S. A.

United Kingdom

503,486. **Condenser.** A. H. Hunt, Ltd., (Solar Mfg. Corp.).
503,877. **Vehicle Spring-Suspension.** B. F. Goodrich Co.
504,076. **Vehicle Suspension.** E. G. Budd Mfg. Co.
504,194. **Vehicle Suspension.** B. F. Goodrich Co
504,347. **Stuffing-Box Packing.** F. G. G. Armstrong.
504,598. **Shock-Absorber.** Metalastik, Ltd., and M. Goldschmidt.
504,613. **Momentum Power-Storing Apparatus.** G. Broulhiet.
504,841. **Stuffing Box.** M. A. Sertillange.
504,886. **Hair-Waving Device.** A. Carlsson.
505,118. **Head-Rest.** R. C. Thomson.
505,144. **Kinematograph Camera.** S. R. Jourjon.
505,145. **Stuffing-Box Substitute.** British Thomson-Houston Co., Ltd.
505,160. **Mudgaurd.** C. F. W. Borgward.
505,184. **Typewriter.** British Tabulating Machine Co., Ltd.
505,205. **Cycle Lamp.** J. Lucas, Ltd., and F. Hanmer.
505,278. **Fabric Coating Machine.** H. Pelagio and N. Da Costa.
505,288. **Stocking.** J. L. Getaz.
505,289. **Shuttle.** J., A., and W. Hodgkinson, (trading as J. Hodgkinson & Sons).
505,304. **Electric Switch.** A. V. Sequin and R. Hirt.
505,309. **Hair Drier.** E. Schiermann.
505,316. **Aircraft Landing-Sail.** E. Krafft and R. Weichardt, (trading as Krafft & Weichardt).
505,329. **Sheep Clippers.** Akt. Separator.
505,341. **Wheel Suspension.** Briggs Mfg. Co.
505,381. **Heat-Measuring Device Soil Tester.** E. H. Reinau.
505,396. **Washing Machine.** Easy Washing Machine Corp.
505,412. **Furnace.** Heraeus-Vacuumschmelze A.G.
505,413. **Tie.** E. Spielmann.
505,414. **Respirator.** B. F. McDonald Co.
505,420. **Driving Gear.** Bayerische Motoren Werke A.G.
505,446. **Centrifuge.** Baird & Tatlock (London), Ltd., and H. J. Fuchs.
505,539. **Machinery Support.** I. L. Haadem.
505,541. **Pedal.** J. A. Phillips & Co., Ltd., and T. J. Boulstridge.
505,579. **Coated Fabric.** Bakelite, Ltd.
505,629. **Airscrew.** De Havilland Aircraft Co., Ltd., and F. M. Thomas.
505,635. **Valve.** E. Topper and W. H. Martin.
505,643. **Cap.** M. Steinbock.
505,658. **Racket Press.** F. A. Mousley & Sons, Ltd., and F. Mousley.
505,741. **Wheel.** Firestone Tire & Rubber Co., Ltd.
505,749. **Treating Materials with Liquids.** C. A. Huttinger.
505,768. **Lamp.** J. Lucas, Ltd., and O. Lucas.
505,812. **Pulp Flow in Paper-Making Machines.** Black-Clawson Co.
505,819. **Goggles.** C. H. Wilen and A. Kramarenko.
505,920. **Saddle.** N. Sluyter.
505,931. **Nozzle.** Forward Electric Co., Ltd., S. H. Twigg, and D. A. Jennings.
505,956. **Cow Milker.** B. V. Orre.
505,960. **Glazing Window Frames.** H. L. Sleigh and A. S. Cheston.
505,974. **Valve.** P. K. Saunders.
505,988. **Bundling Machine.** National Gypsum Co.
505,994. **Tire.** Firestone Tire & Rubber Co., Ltd.
505,997. **Electrically Heated Bonnet.** G. F. Stroher.
506,012. **Heater.** R. E. Davis.
506,030. **Packing.** F. G. G. Armstrong.
506,033. **Valve.** Standard Telephones & Cables, Ltd., and F. D. Goodchild.
506,091. **Capsuling Machine.** R. L. Gangloff.
506,166. **Ball Bladder.** J. Pargeter.
506,204. **Building Block.** Premo Rubber Co., Ltd., and A. Levy.
506,211. **Oscillograph.** Brush Development Co.
506,221. **Surgical Protector.** M. Feiler.
506,233. **Spray Carbureter.** A. Abramson.
506,254. **Packing.** F. G. G. Armstrong.
506,334. **Brake.** B. F. Goodrich Co.
506,339. **Mouthpiece.** H. Schober.
506,345. **Dart Board.** S. A. Spires.
506,346. **Valve.** S. F. Burrows.
506,363. **Fastener.** G H C Corner and Lightning Fasteners, Ltd.
506,418. **Cathode-Ray Tube.** C. Lorenz A.G.

506,487. **Garment Stretcher.** H. R. P. Sorensen and T. C. Hilge.
506,492. **Door Stop.** Wolseley Motors, Ltd., and H. Daniels.
506,494. **Cycle Mudguard.** R. Huppi.
506,516. **Wire Coil.** Marconi's Wireless Telegraph Co., Ltd.
506,556. **Catamenial Belt.** C. W. Eborall, [representative of E. E. Rigold], and C. A. Helmore.
506,559. **Brush.** L. Harford, (H. Daust).
506,582. **Instrument Support.** A. Hillier, (Sperry Gyroscope Co., Inc.).
506,590. **Apparatus to Produce Zinc Dust.** G. W. Johnson, (I. G. Farbenindustrie A.G.).
506,599. **Hydraulic Machine.** O. H. and A. F. Pieper.
506,638. **Punching and Perforating Machine.** D. Broido.
506,645. **Aircraft Propeller.** A. G. Elliott.
506,663. **Massager.** A. C. Mullen.
506,668. **Microphone.** F. W. Alexander and D. E. L. Shorter.
506,689. **Belt.** W. Forstner.
506,705 **Tube Closure.** Steatit-Verkaufsges. A.G.
506,712. **Stapling Continuous Filaments.** Vereinigte Glanzstoff-Fabriken A.G.
506,746. **Wheel Tire.** Firestone Tire & Rubber Co., Ltd.
506,766. **Typewriter.** Akt.-Ges. Vorm. Seidel & Naumann.
506,779. **Pipette Filler.** H. W. Gardner.
506,780. **Press.** A. Friz.
506,808 **Sealing Gasket.** (Latex.) W. W. Triggs. (American Can Co.).
506,821. **Gas-Mask Eyepieces.** V. Horak.
506,868 and 506,870. **Upholstery.** Briggs Mfg. Co.
506,893. **Hose Pipe.** Soc. Italiana Pirelli.
506,944 **Cable.** Soc. Italiana Pirelli.
506,966. **Vehicle Frame.** Auto Union A.G.
507,000. **Insulation.** (Synthetic Rubber.) British Thomson-Houston Co., Ltd.
507,012. **Coating Apparatus.** Bakelite, Ltd.
507,026. **Pipe Joint.** S. C. and L. H. Westwood.
507,074. **Syringe.** H. H. Schulz and Cascadia Products, Ltd.
507,084. **Mounting Articles for Electrolytic Treatment.** Birmingham Aluminum Casting (1903) Co., Ltd., and F. G. Wollard.
507,085. **Valve.** J. Beresford & Son, Ltd., and S. A. Smith.
507,092. **Pinch-Cock.** Automatic Controls, Ltd., and J. A. Currie.
507,104. **Self-Locking Nut.** O. E. Simmonds and Simmonds Development Corp., Ltd.
507,117. **Battery.** J. Grabec and A. Von Ledofsky.
507,148. **Universal Joint.** G. H. Schieferstein.
507,161. **Compound Sheet Material.** (Synthetic Rubber.) H. Dohse.
507,217. **Coating Machine.** British United Shoe Machinery Co., Ltd., (United Shoe Machinery Corp.).
507,249. **Stud and Socket Fastening.** F. A. Oddie.
507,250. **Axle.** Firestone Tire & Rubber Co., Ltd.
507,278. **Storing and Sterilizing Tooth-Pick Apparatus.** C. Eckert.
507,398. **Insole.** H. G. Lumbard.
507,496 and 507,497. **Resilient Joint.** C. A. Voigt.
507,681. **Mounting Motor.** C. A. Voigt.

Germany

680,682. **Valve.** Karl Peter May, Bonn.
680,856. **Driving Belt.** L. Kellenberger & Co., St. Gallen, Switzerland. Represented by H. Leinweber, Berlin.

TRADE MARKS

United States

370,709. **Paris.** Garters, suspenders, etc. A. Stein & Co., Chicago, Ill.
370,741. **Toobfilm.** Tube insertions. D. White, Memphis, Tenn.
370,805. **Figur-Mat.** Mats. Virginia Rubatex Corp., Bedford, Va.
370,814. **Guardress.** Garment shields. W. Stahl, Chicago, Ill.
370,837. **Super Service.** Batteries. Price Battery Corp., Hamburg, Pa.
370,853. Representation of an anchor and the word: **"Grapnel."** Elastic goods. F. Longdon & Co., Ltd., Derby, England.
370,981. **Pliowax.** Resinous material. Goodyear Tire & Rubber Co., Akron, O.
371,011. **De-Luxe.** Billiard table covers. Brunswick-Balke-Collender Co., Chicago, Ill.
371,013. **Spectrafilm.** Film entirely or largely of a rubber derivative. Goodyear Tire & Rubber Co., Akron, O.
371,078. **Olympic.** bathing caps. I. B. Kleinert Rubber Co., New York, N. Y.
371,111. Representation of a series of colored stripes in blue, red, and salmon. Tire patches. Western States Mfg. Co., Sioux City, Iowa.
371,112. Representation of a series of colored stripes in green and salmon. Tire patches. Western States Mfg. Co., Sioux City, Iowa.
371,113. Representation of a series of colored stripes in green, salmon, and red. Tire patches. Western States Mfg. Co., Sioux City, Iowa.
371,122. **Atreo.** Dress shields. Atreo Mfg. Co. New York, N. Y.
371,141. **Givlastic.** Elastic fabrics. Kaylon, Inc., New York, N. Y.
371,189. **T. L. S.** Cleansing preparation. Thodenol Soap Corp., New York, N. Y.
371,190. **Thodenol.** Cleansing preparation. Thodenol Soap Corp., New York, N. Y.
371,198. Representation of a female figure and the words: "Contax Figure Control." Belts, girdles, etc. H. W. Gutowsky, doing business as Star Garter Co., Chicago, Ill.
371,231. Representation of a coil of cord containing the word: **"Neo-Cord."** Soles and heels. Lima Cord Sole & Heel Co., Lima, O.
371,257. **Allegro.** Belts, corsets, etc. Maiden Form Brassiere Co., Inc., New York, N. Y.
371,258. **Duckies.** Waterproof innershoe. W. Mancik, New York, N. Y.
371,340. **Watertite.** Wires and cables. Okonite Co., Passaic, N. J.
371,403. **Samson.** Prophylactic articles. L. M. Schaeffer, doing business as Schaeffer Products Co., Cleveland, O.
371,451. **Iatros.** Prophylactic articles. Merz & Co. Chemical Works, Inc., Newark, N. J.
371,495 **Deeds.** Garters. Dave Beck, Inc., New York, N. Y.
371,513. **Vita-L-Ized.** Footwear. La Crosse Rubber Mills Co., La Crosse, Wis.

Rubber Trade Inquiries

The inquiries that follow have already been answered; nevertheless they are of interest not only in showing the needs of the trade, but because of the possibility that additional information may be furnished by those who read them. The Editor is therefore glad to have those interested communicate with him.

No.	Inquiry
2686	Manufacturers of transparent rubber nipples.
2687	Manufacturers of grinders for producing hard rubber dust.
2688	Manufacturers of lacquer, varnish, or paint capable of resisting alcohol and ammonia and heat resistant in temperatures below the boiling point.
2689	Manufacturers of paints or enamels with rubber bases.
2690	Importers of crude rubber in the United States.
2691	Information wanted on making dipped goods.
2692	Suppliers of rubber latex.
2693	Manufacturers of rubber compounds with high tensile strength and adhesion qualities in contact with metals, wood, plastics, glass, etc.
2694	Manufacturers of rubber display holders for fishing poles.
2695	Manufacturers of metal covers for ice bags.

World Net Imports of Crude Rubber—Long Tons

Year	U.S.A.	U.K.†	Argentine	Australia	Belgium	Canada	France	Greater Germany‡	Italy	Japan	Poland	Sweden	U.S.S.R.	Rest of the World	Total
1937...	592,500	135,900	9,500	19,300	15,000	36,100	60,000	115,000	24,000	62,200	6,100	6,700	30,400	52,600	1,120,400
1938...	406,330	168,172	7,653	12,309	11,310	25,696	58,148	107,917	28,170	46,307	7,849	8,304	26,219*	49,174	927,438
1939															
Jan. ..	36,614	7,121	417	954	898	2,867	4,694	9,095	2,133	2,553	665	643	4,000*	4,282	70,651
Feb. ..	30,578	8,087	1,092	1,785	1,068	1,451	5,327	8,348	2,025	3,263	709	467	1,000*	4,824	66,710
Mar. ..	45,286	12,092	440	1,324	1,242	2,458	4,503	9,028	1,525	4,019	985	581	2,000*	4,901	85,374
Apr. ..	31,590	7,129	786	1,138	855	1,466	5,650	9,316	1,926	3,579	673	994	2,000*	4,304	69,119
May ..	45,390	10,488	353	1,202	792	3,006	4,646	9,031	1,573	4,438	940	1,047	1,000*	5,800	86,749
June ..	33,950	10,287	965	1,348	621	2,423	4,649	8,677	1,992	3,067	693	2,252	500*	4,733	74,166
July ..	36,932	6,309	600*	1,472	859	3,164	4,282	8,847	1,350	3,668	750*	644	1,000*	4,407	72,017

*Estimated. †U. K. figures show gross imports, not net imports. ‡Including imports of Austria and Czechoslovakia. Source: *Statistical Bulletin of the International Rubber Regulation Committee.*

Shipments of Crude Rubber from Producing Countries—Long Tons

Year	Malaya including Brunei and Labuan	N.E.I.	Ceylon	India	Burma	North Borneo	Sarawak	Thailand	French Indo-China	Total	Philippines and Oceania	Liberia†	Other Africa	South America	Mexican Guayule	Grand Total
1937......	469,900	431,700	70,400	9,800	7,200	13,200	25,900	35,600	43,400	1,107,100	1,600*	2,300	9,100	16,300	3,400	1,139,800
1938......	372,046	298,101	49,528	8,455	6,737	9,512	17,792	41,618	59,156	862,945	1,971*	2,929	9,000*	15,337	2,758	894,940
1939																
Jan.	24,393	38,678	7,237	764	1,115	1,604	2,342	2,918	4,739	83,790	220	528	800	1,812	347	87,497
Feb.	29,278	24,996	5,495	947	618	664	1,484	5,606	5,659	74,747	158	435	800	1,187	319	77,646
Mar.	29,298	27,934	3,718	774	619	344	1,177	5,401	4,636	73,901	230	427	800	1,407	210	76,975
Apr.	29,779	28,341	2,225	881	379	1,687	2,446	2,660	2,581	70,979	135	533	800	1,206	167	73,820
May	29,598	24,429	2,805	1,002	668	558	1,649	2,782	4,585	68,076	129	500*	800	1,077	231	70,813
June	22,052	27,511	3,708	630	805	332	1,157	1,748	4,030	61,973	137	667	800	676	157†	64,410
July	26,013	35,676	5,019	782	503	1,603	3,092	5,599	3,367	81,654	150*	516	800	1,071	250*	84,441
Aug.	40,973	27,357	5,482	214	213	975	1,749	5,230	7,020	89,213	150*	500*	800	1,313	250*	92,226

*Estimated. †Guayule rubber imports into U.S.A. and Germany provisional until export figures from Mexico are received. Source: *Statistical Bulletin of the International Rubber Regulation Committee.*

Market Reviews

CRUDE RUBBER

Commodity Exchange

TABULATED WEEK-END CLOSING PRICES OF THE NEW YORK MARKET

Futures	Aug. 26	Sept. 30	Oct. 7	Oct. 14	Oct. 21
Sept.	16.75	.....	.....	.....	.....
Oct.	.....	19.90	18.96	19.75	20.50
Dec.	16.48	19.65	18.69	19.55	20.38
Mar.	16.41	18.60	17.75	18.43	18.88
July	16.37	18.50	17.56	18.20	18.43
Sept.	.....	.....	17.55	18.20	18.40
Volume per week (tons)	7,860	8,270	9,170	3,140	9,690

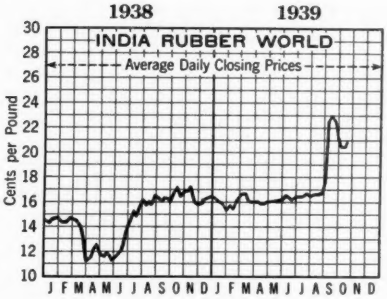
THE rubber market ruled generally firm during October, with prices holding closely to the levels established after the outbreak of the war. The uncertainty regarding developments in Europe and neutrality legislation in Washington resulted in cautious and hesitant trading throughout the month. The price of December futures closed at 19.65¢ per pound on September 30 and then became somewhat easier, closing at 18.69¢ on October 7. Thereafter the market was stronger, and the price advanced to close at 20.38¢ on October 21. The closing price on October 30 was 19.90¢ a pound. Trading during the month was light. Commodity Exchange officials have been watching the December contract position and are said to be determined to prevent a squeeze in that delivery month. Confidence by officials that a squeeze might be avoided is partly due to the large tonnage of rubber afloat to this country.

On October 3 the International Rubber Regulation Committee raised the export quota for the fourth quarter of 1939 from 70 to 75% of basic quotas. This action will permit the release of an added 6,000 tons of rubber per month and should assist in alleviating the tight supply situation in major consuming countries.

It is currently anticipated that crude rubber consumption in the United States during October will be slightly higher than the September figure of 50,150 tons. Stocks on hand at the end of September, 150,171 tons, were the lowest since May, 1930, and at the current rate of consumption in this country represent less than three months' supply. It has been estimated by The Rubber Manufacturers Association, Inc., that re-exports of crude rubber from this country during September totaled 3,200 tons as compared with the average of 400 tons during preceding months. The large amount of rubber afloat, 68,310 long tons as of September 30, should check the decline in stocks.

According to the *Rubber News Letter*, issued by the Leather and Rubber Division on October 15, shipping and communication have been disrupted to some extent as a result of war. It is the general belief, however, that adequate shipping services for rubber will be maintained.

The Brazilian Government is preparing plans for increasing the production of rubber in that country, and a project calling for a national rubber council has been laid before President Vargas of Brazil.



New York Outside Market—Spot Ribbed Smoked Sheets

New York Quotations

New York outside market rubber quotations in cents per pound

	Oct. 26, 1938	Sept. 28, 1939	Oct. 27, 1939
Plantations			
Rubber latex..*gal.*	*61/62*	*76/77*	*78/79*
Paras			
Upriver fine	15¼	18½	16¾
Upriver fine	*18¼	*21½	*21½
Upriver coarse...	10	13	11½
Upriver coarse...	*14½	*20	*19
Islands fine......	15	18	17
Islands fine......	*17½	*21	*21
Acre, Bolivian fine	15½	19	17
Acre, Bolivian fine	*18½	*22	*22
Beni, Bolivian fine	16	20	18
Madeira fine	15½	18¾	16¾
Caucho			
Upper ball.......	10	13	11½
Upper ball.......	*14½	*20	*19
Lower ball.......	9¾	12	11
Pontianak			
Pressed block ...	11/20	11/18	13/18
Guayule			
Ampar	13¾	13¼	15
Africans			
Rio Nuñez	14	18	17½
Black Kassai ...	14	18	17½
Prime Niger flake.	25	21	25
Gutta Percha			
Gutta Siak	11½	14	15
Gutta Soh	15	18	17
Red Macassar....	1.20/1.85	1.30	1.20
Balata			
Block, Ciudad Bolivar	..	33	32
Manaos block ...	27	33	32
Surinam sheets...	39	43	43
Amber	42	45	45

*Washed and dried crepe. Shipments from Brazil.

New York Outside Market

The outside market ruled generally quiet during October although a fair amount of factory business was reported. Offerings from the Far East were generally scarce and too high for the local market. Latex crepe grades are commanding a greater premium than usual. The market held steady during the month, with the price of No. 1 ribbed smoked sheets closing at 21¢ per pound on September 30 and holding at this level within narrow limits during October to close at 20⅞¢ per pound on October 21. The closing price on October 30 was 20½¢ per pound. The week-end closing prices on No. 1 ribbed smoked sheets follow: September 30, 21¢; October 7, 20¼¢; October 14, 20½¢; October 21, 20⅞¢; and October 28, 20½c.

Rubber and Canvas Footwear Statistics

Thousands of Pairs

	Inventory	Production	Shipments
1937	20,430	74,102	67,191
1938	16,183	50,812	54,942
1939			
Jan.	16,157	4,807	4,778
Feb.	16,582	4,953	4,629
Mar.	17,281	5,897	5,214
Apr.	18,083	5,216	4,414
May	19,055	5,033	4,017
June	19,729	4,866	4,192
July	18,115	3,280	4,894
Aug.	16,956	5,090	6,213

The above figures have been adjusted to represent 100% of the industry based on reports received which represented 81% for 1936-37.

Source: *Survey of Current Business*, Bureau of Foreign & Domestic Commerce, Washington.

New York Outside Market — Spot Closing Prices — Plantation Grades — Cents per Pound

	Sept. 1939 25	26	27	28	29	30
No. 1 Ribbed Smoked Sheet.	21½	21½	21	21	20¾	21
No. 1 Thin Latex Crepe.....	22½	22½	22	22	22	22¼
No. 2 Thick Latex Crepe...	22½	22½	22	22	22	22¼
No. 1 Brown Crepe........	20¾	20¾	20¼	20¼	19¾	20
No. 2 Brown Crepe........	20½	20½	20	20	19½	19¾
No. 2 Amber...............	20¾	20¾	20¼	20¼	19¾	20
No. 3 Amber...............	20½	20½	20	20	19½	19¾
Rolled Brown..............	20	20	19½	19½	17½	17¾

	Oct. 1939 2	3	4	5	6	7	9	10	11	12*
No. 1 Ribbed Smoked Sheet.	21	20¾	20¼	20½	20½	20¼	20¼	20½	20¾	..
No. 1 Thin Latex Crepe.....	22¼	22	21½	21¾	21¾	21½	22	22¼	22½	..
No. 2 Thick Latex Crepe...	22¼	22	21½	21¾	21¾	21½	22	22¼	22½	..
No. 1 Brown Crepe........	20	19¾	19¼	19½	19½	19¼	19¼	19½	18¾	..
No. 2 Brown Crepe........	19¾	19½	19	19¼	19¼	19	19	19¼	18½	..
No. 2 Amber...............	20	19¾	19¼	19½	19½	19¼	19¼	19½	18¾	..
No. 3 Amber...............	19¾	19½	19	19¼	19¼	19	19	19¼	18½	..
Rolled Brown..............	17¾	17½	17	17¼	17¼	17	17	17¼	17	..

	Oct. 1939 13	14	16	17	18	19	20	21
No. 1 Ribbed Smoked Sheet.	20½	20½	20½	20¾	21½	21	20⅞	20⅞
No. 1 Thin Latex Crepe.....	22½	22½	22½	22¾	23¼	23¼	23⅛	23⅛
No. 2 Thick Latex Crepe...	21½	21½	21½	21¾	22¼	22¾	22⅝	22⅝
No. 1 Brown Crepe........	18¾	18¾	18¾	19	19½	19	18⅞	18⅞
No. 2 Brown Crepe........	18½	18½	18½	18¾	19¼	18¾	18⅝	18⅝
No. 2 Amber...............	18¾	18¾	18¾	19	19½	19	18⅞	18⅞
No. 3 Amber...............	18½	18½	18½	18¾	19¼	18¾	18⅝	18⅝
Rolled Brown..............	17	17	17	17¼	17¾	18	17⅞	17⅞

*Holiday.

 ADVERTISING PAGES REMOVED

IMPORTS, CONSUMPTION AND STOCKS

CRUDE rubber consumption by United States manufacturers during September is estimated at 50,150 long tons, less than 1% under the 50,481 long tons of August and 24.8% more than the 40,183 (revised) long tons of September, 1938, according to the R.M.A.

Gross imports of crude rubber for September are reported to be 41,939 long tons, 10.2% over the August figure of 38,045 long tons and 12.2% over the 37,374 long tons which were imported during September, 1938.

Domestic stocks of crude rubber on hand September 30 totaled 150,171 long tons, against August 31 stocks of 161,362 long tons and 268,094 (revised) long tons that were reported on hand September 30, 1938.

Crude rubber afloat to United States ports as of September 30 is estimated to be 68,310 long tons, compared with 66,717 long tons afloat on August 31 and 48,927 long tons afloat on September 30, 1938.

United States and World Statistics of Rubber Imports, Exports, Consumption, and Stocks—Long Tons

Twelve Months	U. S. Imports*	U. S. Consumption¶	U. S. Stocks Mfgrs., Importers, Dealers, Etc.†	U. S. Stocks Afloat†	U. K.—Public Warehouses, London Liverpool†‡	Singapore and Penang Dealers and Port Stocks†‡	World Production (Net Exports)‡	World Consumption Estimated‡	World Stocks†‡§
1937	584,851	543,600	262,204	63,099	57,785	44,792	1,139,800	1,104,891	646,252
1938	400,178	437,031	231,500	45,105	86,853	27,084	894,940	941,482	596,498
1939									
Jan.	39,082	46,234	223,879	48,210	80,643	30,975	87,497	89,065	585,812
Feb.	36,490	42,365	217,534	55,814	75,517	28,559	77,646	83,933	569,161
Mar.	38.989	50.165	205.936	55.981	72,235	23,255	76,975	95,099	545,840
Apr.	29,601	44,166	190,896	57,918	68,931	22,434	73,865	86,674	519,032
May	47,535	44,377	193,602	54,046	66,020	20,849	70,813	89,283	512,228
June	35,947	47.259	181.794	51.274	63.878	19,563	64,410	90,927	491,689
July	36,739	43.880	174.240	52,990	57,234	27,042	84,441	87,184	....
Aug.	38,045	50,481	161,362	66,717	45,621	20,570	92,226	95,557	....
Sept.	41,939	50,150	150,171	68,310	......	......	......	......	......

*Including liquid latex. †Stocks on hand the last of the month or year. ‡Statistical Bulletin of the International Rubber Regulation Committee. §Stocks at U. S. A., U. K., Singapore and Penang, Para, Manaos, regulated areas, and afloat. ¶Corrected to 100% from estimate of reported coverage.
a Include stocks from Japan.

RECLAIMED RUBBER

ACCORDING to R. M. A. figures, September reclaimed rubber consumption is estimated at 16,953 long tons, 0.6% above that of August; production, 17,990 long tons; stocks on hand September 30, 21,185 long tons. Demand during October was active with reclaim moving into all consuming channels in large volume. Consumption of reclaim during the past month is expected to be slightly higher than that of September.

The market is firm with the prices of all grades of reclaim continuing at last month's levels with the exception of white reclaim which is now 12½ to 14¢ per pound instead of 12 to 14½¢, quoted last month.

New York Quotations

October 24, 1939

	Sp. Grav.	¢ per lb.
Auto Tire		
Black Select	1.16-1.18	6 / 6¼
Acid	1.18-1.22	7 / 7¼
Shoe		
Standard	1.56-1.60	6½/ 6¾
Tubes		
Red Tube	1.15-1.30	9 / 9¼
Compound	1.10-1.20	9 /10
Miscellaneous		
Mechanical Blends ...	1.25-1.50	4½/ 5
White	1.35-1.50	12½/14

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

United States Reclaimed Rubber Statistics—Long Tons

Year	Production	Consumption†	Consumption % to Crude	U. S. Stocks*	Exports
1937	185,033	162,000	29.8	28,800	13,233
1938	122,403	120,800	27.6	23,000	7,403
1939					
Jan.	14,826	13,743	29.7	23,334	748
Feb.	14,102	13,347	31.5	23,461	630
Mar.	15,647	16,197	32.3	22.155	756
Apr.	14.527	13.391	30.3	22.628	748
May	14,769	13,517	30.5	22,771	1,008
June	15,871	14,870	31.5	23,058	759
July	12,588	13,542	30.9	21,339	1,036
Aug.	17,595	16,846	33.4	21,024	843
Sept.	17,990	16,953	33.8	21,185	...

*Stocks on hand the last of the month or year. †Corrected to 100% from estimate of reported coverage.
Compiled by The Rubber Manufacturers Association, Inc.

RUBBER SCRAP

THE demand for scrap rubber during October continued active with reclaim production at a high level. Small dealers continue to be somewhat reluctant in the sale of their scrap.

The market is firm, and all grades of scrap remain at last month's quotations except solid tires and tire carcass which advanced in price.

Consumers' Buying Prices

(Carload Lots for October 24, 1939)

		Prices
Boots and Shoes		
Boots and shoes, black....	*lb.*	$0.01 /$0.01⅛
Colored	*lb.*	.00¾/ .00⅞
Untrimmed arctics	*lb.*	.00¼/ .00⅜
Inner Tubes		
No. 1, floating............	*lb.*	.09½/ .10
No. 2, compound.........	*lb.*	.05 / .05⅛
Red	*lb.*	.04¾/ .05
Mixed tubes	*lb.*	.04½/ .04¾
Tires (Akron District)		
Pneumatic Standard		
Mixed auto tires with beads	*ton*	15.00 /16.50
Beadless	*ton*	19.50 /20.00
Auto tire carcass.......	*ton*	30.00 /35.00
Black auto peelings.....	*ton*	26.00 /27.00
Solid		
Cream mixed truck......	*ton*	33.00 /34.00
Light gravity	*ton*	42.00 /44.00
Mechanicals		
Mixed black scrap........	*ton*	20.00 /22.00
Hose, air brake..........	*ton*	20.00 /22.50
Garden, rubber covered.	*ton*	11.50 /13.00
Steam and water, soft..	*ton*	11.50 /13.00
No. 1 red................	*lb.*	.03 / .03¼
No. 2 red................	*lb.*	.02¼/ .02½
White druggists' sundries..	*lb.*	.03¾/ .04
Mixed mechanicals	*lb.*	.02¼/ .02½
White mechanicals	*lb.*	.03⅝/ .03¾
Hard Rubber		
No. 1 hard rubber	*lb.*	.11 / .11½

Bibliography

(*Continued from page 63*)

QUANTITATIVE DETERMINATION OF ZINC IN TRANSPARENT RUBBER GOODS. E. Casazza, *Gomma*, May-June, 1939, pp. 65-67.

A NEW INVESTIGATION METHOD FOR EVALUATING FILLERS FOR THE RUBBER INDUSTRY. J. Behre, *Kautschuk*, Sept., 1939, pp. 160-66.

INSULATION MATERIALS IN ELECTROTECHNICS. St. Reiner, *Gummi-Ztg.*, Aug. 4, 1939, pp. 819-20. (Conclusion.)

CHLORINATED RUBBER: VARIOUS APPLICATIONS, ESPECIALLY IN THE VARNISH INDUSTRY. F. Chevassus, *Caoutchouc & gutta-percha*, Aug. 15, 1939, pp. 205-206.

RUBBER AS CONSTRUCTION ELEMENT. B. Steinborn, *Kautschuk*, Aug., 1939, pp. 146-52.

CONTRIBUTION TO THE KNOWLEDGE OF CHLORINATED RUBBER. O. Schweitzer, *Kautschuk*, Aug., 1939, pp. 152-54.

STATIC AND DYNAMIC PROPERTIES OF RUBBER UNDER COMPRESSION. C. W. Kosten, Communications of the Rubber Foundation, No. 10, Dec., 1938, pp. 5-27.

THE SYNTHESIS OF RUBBER. C. Koningsberger, Communications of the Rubber Foundation, No. 12, Jan., 1939, 36 pp. (Dutch.)

THE USE OF PNEUMATIC TIRES IN AGRICULTURE. C. Kuijper, Communications of the Rubber Foundation, No. 13, Apr., 1939, pp. 7-39. (Dutch.)

COMPOUNDING INGREDIENTS

THE demand for compounding ingredients during October was at a high level. Rubber manufacturing activities have continued their upward trend, and it is expected that the current heavy demand for compounding materials will be sustained at least for the balance of this year. Prices in general are firm, but unchanged.

CARBON BLACK. Domestic sales were equal to or slightly better than those of September. The price is unchanged.

FACTICE OR RUBBER SUBSTITUTE. The demand was active with rubber manufacturers buying in large volume. The heavy demand for vegetable oils has caused a shortage of some types, with a natural rise in value. Higher prices for substitutes are expected to follow when present oil stocks are depleted.

LITHARGE. The demand was steady, with quotations unchanged.

LITHOPONE. Demand for this pigment held at a satisfactory level during the past month. The price is firm.

RUBBER CHEMICALS. The demand for accelerators and antioxidants continued excellent in the domestic market. Because of the curtailing of British, French, and German supplies in other markets, an increase in export demand is expected. Prices are unchanged.

RUBBER SOLVENTS. The tank-car price of these solvents was advanced ½¢ per gallon last month to the new level of 9½¢ per gallon. Tire makers were active buyers, and the price increase did not tend to lessen interest. The trend of the consumption of petroleum solvents by the rubber industry continues to be toward the lighter fractions.

TITANIUM PIGMENTS. These pigments held at a high level of demand during October. The price is firm and probably will not change before next June unless some unforeseen development occurs.

ZINC OXIDE. Both rubber and paint consumers have been taking shipments in good volume. The price continues unchanged, and no change is expected before next year.

New York Quotations*

October 25, 1939

Abrasives

Pumicestone, powdered	lb.	$0.03	/$0.035
Rottenstone, domestic	lb.	.03	/ .035
Silica, 15	ton		

Accelerators, Inorganic

Lime, hydrated, l.c.l., New York	ton	20.00	
Litharge (commercial)	lb.	.0675/	.0725

Accelerators, Organic

A-1	lb.	.24	/ .30
A-10	lb.	.31	/ .35
A-11	lb.	.52	/ .65
A-19	lb.	.52	/ .65
A-32	lb.	.70	/ .80
A-77	lb.	.42	/ .55
A-100	lb.	.42	/ .55
Accelerator 49	lb.	.40	/ .42
737	lb.	.42	/ .43
737-50	lb.	.25	/ .26
808	lb.	.70	/ .72
833	lb.	1.15	
Acrin	lb.	.60	
Aldehyde ammonia	lb.	.70	
Altax	lb.	.55	/ .70
B-J-F	lb.	.50	/ .55
Beutene	lb.	.70	/ .75
Butyl Eight	lb.		
Zimate	lb.	2.50	
C-P-B	lb.	2.00	
Captax	lb.	.50	/ .60
Crylene	lb.	.40	/ .47
Paste	lb.	.30	/ .36
D-B-A	lb.	2.00	
Delac A	lb.	.40	/ .50
O	lb.	.40	/ .50
P	lb.	.40	/ .50
Di-Esterex	lb.	.60	/ .70
N	lb.	.60	/ .70
DOTG (Di-ortho-tolylguanidine)	lb.	.44	/ .46
DPG (Diphenylguanidine)	lb.	.35	/ .36
El-Sixty	lb.	.50	/ .65
Ethylideneaniline	lb.	.42	/ .43
Ethyl Zimate	lb.	2.50	
Formaldehyde P.A.C.	lb.	.0625	
Formaldehydeaniline	lb.	.31	
Formaldehyde-para-toluidine	lb.	.52	/ .54
Guantal	lb.	.40	/ .50
Hepteen	lb.	.35	/ .40
Base	lb.	1.35	/ 1.50
Hexamethylenetetramine U.S.P.	lb.	.39	
Technical	lb.	.33	
Lead oleate, No. 999	lb.	.13	
Witco	lb.	.15	
Monex	lb.	2.35	
Novex	lb.		
O. N. V.	lb.	1.00	/ 1.10
O-X-A-F	lb.	$0.50	/$0.55
Ovac	lb.	.50	/ .55
Para-nitroso-dimethylaniline	lb.	.85	
Pentex	lb.	1.00	/ 1.10
Flour	lb.	.15	/ .16
Pip-Pip	lb.	2.50	
Pipsolene	lb.	1.55	/ 1.85
R-2	lb.	1.40	/ 1.80
R-23	lb.	.40	
R & H 50-D	lb.	.42	/ .43
Rotax	lb.	.60	/ .65
Safex	lb.	1.20	/ 1.30
Santocure	lb.	.80	/ 1.00
Super-sulphur No. 1	lb.	.50	
2	lb.	.18	/ .25
Tetrone A	lb.	2.70	
Thiocarbanilide	lb.	.24	
Thionex	lb.	2.35	
Trimene	lb.	.55	/ .65
Base	lb.	1.05	/ 1.20
Triphenylguanidine (TPG)	lb.	.45	
Tuads	lb.	2.35	
Ureka	lb.	.60	/ .75
Blend B	lb.	.60	/ .75
C	lb.	.56	/ .65
Vulcanex	lb.	.42	/ .43
Vulcanol	lb.	.85	
Z-B-X	lb.	2.50	
Zenite	lb.	.46	/ .48
A	lb.	.53	/ .55
B	lb.	.46	/ .48
Zimate	lb.	2.35	

*Prices not recorded will be supplied on application.

Activator

Aero Ac 50	lb.	.46	/ .52
Barak	lb.	.50	

Age Resisters

AgeRite Alba	lb.	1.50	/ 2.00
Exel	lb.	1.00	/ 1.40
Gel	lb.	.57	/ .75
Hipar	lb.	.65	/ .92
Powder	lb.	.52	/ .65
Resin	lb.	.52	/ .65
D	lb.	.52	/ .65
White	lb.	1.25	/ 1.65
Akroflex C	lb.	.56	/ .58
Albasan	lb.	.70	/ .75
Aminox	lb.	.52	/ .61
Antox	lb.	.56	
B-L-E	lb.	.52	/ .61
Powder	lb.	.65	/ .74
B-X-A	lb.	.52	/ .61
Copper Inhibitor X-872-A	lb.	1.15	
Flectol B.	lb.	.52	/ .65
H	lb.	.52	/ .65
White	lb.	.90	/ 1.15
M-U-F	lb.	1.50	
Neozone (standard)	lb.	.63	
A	lb.	.52	/ .54
B	lb.	.63	
C	lb.	.52	/ .54
D	lb.	.52	/ .54
E	lb.	.63	
Oxynone	lb.	.64	/ .80
Parazone	lb.	.68	
Permalux	lb.	1.20	
Santoflex B	lb.	$0.52	/$0.65
Solux	lb.	1.30	
Thermoflex A	lb.	.65	/ .67
V-G-B	lb.	.52	/ .61

Alkalies

Caustic soda, flake, Columbia (400 lb. drums)	100 lbs.	2.70	/ 3.55
liquid, 50%	100 lbs.	1.95	
solid (700 lb. drums)	100 lbs.	2.30	/ 3.15

Antiscorch Materials

A-F-B	lb.	.35	/ .40
Antiscorch T	lb.	.90	
E-S-E-N	lb.	.35	/ .40
R-17 Resin (drums)	lb.	.10	
RM	lb.	1.25	
Retarder W	lb.	.36	
U.T.B.	lb.	.35	/ .40

Antisun Materials

Heliozone	lb.	.21	
Sunproof	lb.	.20	/ .25

Colors

Black			
Du Pont powder	lb.	.42	/ .44
Lampblack (commercial)	lb.	.15	
Blue			
Brilliant	lb.		
Du Pont dispersed	lb.	.83	/ 3.60
Powders	lb.	2.25	/ 3.75
Prussian	lb.		
Toners	lb.	.08	/ 3.85
Brown			
Mapico	lb.	.11	
Green			
Brilliant	lb.		
Chrome, light	lb.		
medium	lb.	.22	
oxide (freight allowed)	lb.		
Dark	lb.		
Du Pont dispersed	lb.	.98	/ 1.75
Powders	lb.	1.00	/ 2.00
Guignet's, Easton, Pa., bbls.	lb.	.70	
Light	lb.		
Toners	lb.	.85	/ 3.75
Orange			
Du Pont dispersed	lb.	.88	/ .90
Powders	lb.	.80	/ 2.50
Lake	lb.		
Toners	lb.	.40	/ 1.60
Orchid			
Toners	lb.	1.50	/ 2.00
Pink			
Toners	lb.	1.50	/ 2.00
Purple			
Permanent	lb.		
Toners	lb.	.60	/ 2.10
Red			
Antimony			
Crimson, 15/17%	lb.		
R. M. P. No. 3	lb.	48	
Sulphur free	lb.		
R.M.P.	lb.	.52	
Golden 15/17%	lb.		
7-A	lb.	.37	
Z-2	lb.	.23	
Aristi	lb.		
Cadmium, light (400 lb. bbls.)	lb.	.75	/ .80
Chinese	lb.		
Crimson	lb.		
Du Pont dispersed	lb.	.93	/ 2.05
Powders	lb.	.52	/ 1.05
Mapico	lb.	.0925	
Medium	lb.		
Rub-Er-Red, Easton, Pa., bbls.	lb.	.0925	
Scarlet	lb.		
Toners	lb.	.08	/ 2.00
White			
Lithopone (bags)	lb.	.0375/	.04
Albalith Black Label-11	lb.	.0375/	.04
Astrolith	lb.	.0375/	.04
Azolith	lb.	.0375/	.04
Cryptone-BA-19	lb.	.0525/	.055
BT	lb.	.0525/	.055
CB	lb.	.0525/	.055
ZS No. 20	lb.	.075 /	.0775
86	lb.	.075 /	.0775
230	lb.	.075 /	.0775
Sunolith	lb.	.0375/	.04
Ray-Bar	lb.	.0525/	.0625
Ray-Cal	lb.	.0525/	.0625
Rayox	lb.	.13 /	.16
Titanolith (5-ton lots)	lb.	.0525/	.055
Titanox-A (50-lb. bags)	lb.	.13 /	.1375
B (50-lb. bags)	lb.	.0525/	.055
30 (50-lb. bags)	lb.	.0525/	.055
C (50-lb. bags)	lb.	.0525/	.055
M (50-lb. bags)	lb.	.0525/	.055
Ti-Tone	lb.		
Zinc Oxide			
Azo ZZZ-11	lb.	.0625/	.065
44	lb.	.0625/	.065
55	lb.	.0625/	.065
66	lb.	.0625/	.065
French Process, Florence			
White Seal-7 (bbls.)	lb.	.085 /	.0875
Green Seal-8	lb.	.08 /	.0825
Red Seal-9	lb.	.075 /	.0775

Kadox, Black Label-15 ... lb. $0.065 /$0.0675
No. 25 ... lb. .075 / .0775
Red Label-17 ... lb. .065 / .0675
Horse Head Special 3 ... lb. .0625/ .065
XX Red-4 ... lb. .0625/ .065
23 ... lb. .0625/ .065
72 ... lb. .0625/ .065
78 ... lb. .0625/ .065
80 ... lb. .0625/ .065
103 ... lb. .0625/ .065
110 ... lb. .0625/ .065
St. Joe (lead free)
Black Label ... lb. .0625/ .065
Green Label ... lb. .0625/ .065
Red Label ... lb. .0625/ .065
U.S.P. ... lb. .095 / .0975
White Jack ... lb. .075 / .0775
Zopaque ... lb. .13 / .1375

Yellow
Cadmolith (cadmium yellow), 400 lb. bbls. ... lb. .50 / .55
Du Pont dispersed ... lb. 1.25 / 1.75
Powders ... lb. 1.55 / 1.37
Lemon ... lb.
Mapico ... lb. .0675
Toners ... lb. 2.50

Dispersing Agents
Darvan ... lb. .30 / .47
Nevoll (drums) ... lb. .0215
Santomerse S ... lb. .11 / .25

Fillers, Inert
Asbestine, c.l., f.o.b., mills. ton 15.00
Barytes ... ton 30.00 /36.00
f.o.b., St. Louis (50 lb. paper bags) ... ton 22.85
off color, domestic ... ton 20.00 /25.00
white, imported ... ton 29.00 /32.00
Blanc fixe, dry, precip. ... lb. .03 / .035
Calcene ... ton 37.50 /43.00
Infusorial earth ... lb. .02 / .03
Kalite No. 1 ... ton 24.00 /50.00
3 ... ton 34.00 /60.00
Magnesia, calcined, heavy ... lb. .04
Carbonate, l.c.l. ... lb. .07 / .095
Pyrax A ... ton 6.50 /20.00
Whiting
Columbia Filler ... ton 9.00 /14.00
Guilders ... 100 lbs.
Paris white, English cliff-stone ... 100 lbs.
Southwark Brand, Commercial ... 100 lbs.
All other grades ... 100 lbs.
Suprex, white extra light. ton 45.00 /60.00
heavy ... ton 45.00 / 60.00
Witco, c.l. ... ton 6.00

Finishes
Rubber lacquer, clear ... gal.
colored ... gal.
Starch, corn, pwd. ... 100 lbs.
potato ... lb.
Talc ... ton 25.00 /45.00

Flock
Cotton flock, dark ... lb. .105 / .13
dyed ... lb. .45 / .85
white ... lb. .12 / .18
Rayon flock, colored ... lb. 1.10 / 1.50
white ... lb. .90

Latex Compounding Ingredients
Accelerator 85 ... lb. .35
89 ... lb. 1.40
122 ... lb. 1.55
552 ... lb. 2.50
Aerosol OT Aqueous 10% ... lb. .15 / .25
Antox, dispersed ... lb. .42
Aquarex A ... lb. .35
D ... lb. .75
F ... lb. .85
WA Paste ... lb. .25
Areskap No. 50 ... lb. .18 / .24
100, dry ... lb. .39 / .51
Aresket No. 240 ... lb. .16 / .22
300, dry ... lb. .42 / .50
Aresklene No. 375 ... lb. .35 / .50
400, dry ... lb. .51 / .65
Black No. 25, dispersed ... lb. .22 / .40
Catalpo ... ton
Collocarb ... lb. .055 / .07
Color Pastes, dispersed ... lb. .35 / 1.90
Dispersex No. 15 ... lb. .11 / .12
No. 20 ... lb. .08 / .10
Emo, brown ... lb. .15
white ... lb. .15
Factice Compound, dispersed ... lb. .36
Heliozone, dispersed ... lb. .25
Igepon A ... lb.
MICRONEX, Colloidal ... lb. .055 / .07
Nekal BX (dry) ... lb.
Palmol ... lb. .12
Pipsol X ... lb. 3.05 / 3.55
R-2 Crystals ... lb. 2.50 / 2.75
R-23 ... lb. .40
R-N-2 ... lb. 1.40 / 1.80
Crystals ... lb. 2.00 / 2.25
S.1 (400 lb. drums) ... lb. .65
Santomerse D ... lb. .41 / .65
S ... lb. .11 / .25
No. 1 ... lb. .18 / .35
No. 2 ... lb. .18 / .35
No. 3 ... lb. .40 / .65
No. 3P ... lb. .29 / .45

Santovar A ... lb. $1.15 /$1.40
Stablex A ... lb. .90 / 1.10
B ... lb. .65 / .90
C ... lb. .40 / .50
Sulphur, dispersed ... lb. .10 / .15
No. 2 ... lb. .075 / .15
T.1. (400 lb. drums) ... lb. .40
Tepidone ... lb. 1.45
Vulcan Colors ... lb.
Zinc oxide, dispersed ... lb. .12 / .15

Mineral Rubber
Black Diamond ... ton 25.00
Hydrocarbon, hard ... ton 21.00 /42.00
Parmr ... ton 21.00 /27.00
Pioneer ... ton
285°-300° ... ton 21.00 /42.00

Mold Lubricants
Mold Paste ... lb. .12 / .18
Sericite ... ton 65.00 /75.00
Soapbark ... lb.
Soapstone ... ton 25.00 /35.00

Oil Resistant
AXF ... lb. .40 / .50

Reenforcers
Carbon Black
Aerfloted Arrow Specification Black ... lb. .0275/ .0625
Arrow Compact Granulized Carbon Black ... lb. .0275/ .0625
"Certified" Heavy Compressed, Cabot ... lb.
Spheron ... lb.
Continental Dustless, c.l. ... lb. .0275
Compressed, c.l. ... lb. .0275
Uncompressed, c.l. ... lb. .0275
Disperso, c.l. ... lb. .0275/ .0375
Dixie, c.l., f.o.b. New Orleans, La., Galveston or Houston, Tex. ... lb. .0275
c.l., delivered New York. lb. .0375
local stock, bags, delivered ... lb. .0625
Dixiedensed, c.l., f.o.b., New Orleans, La., Galveston or Houston, Tex. ... lb. .0275
c.l., delivered New York. lb. .0375
local stock, bags, delivered ... lb. .0625
Dixiedensed, 66, c.l., f.o.b., New Orleans, La., Galveston or Houston, Tex. ... lb. .0275
c.l., delivered New York. lb. .0375
local stock, bags, delivered ... lb. .0625
Excello, c.l., f.o.b., Gulf ports ... 100 lbs. 2.75 / 4.75
delivered New York. 100 lbs. 3.75 / 5.75
l.c.l., delivered New York ... 100 lbs. 6.25 / 7.00
Fumonex, c.l., f.o.b. works. lb. .03
ex-warehouse ... lb. .05
Gastex ... lb. .03 / .07
Kosmobile, c.l., f.o.b. New Orleans, La., Galveston or Houston, Tex. ... lb. .0275
c.l., delivered New York. lb. .0375
local stock, bags, delivered ... lb. .0625
Kosmobile 66, c.l., f.o.b. New Orleans, La., Galveston or Houston, Tex. ... lb. .0275
c.l., delivered New York. lb. .0375
local stock, bags, delivered ... lb. .0625
Kosmos, c.l., f.o.b. New Orleans, La., Galveston or Houston, Tex. ... lb. .0275
c.l., delivered New York. lb. .0375
local stock, bags, delivered ... lb. .0625
MICRONEX Beads, c.l., f.o.b. Gulf ports ... lb. .0275
c.l., delivered, New York ... lb. .0375
local stock, bags, delivered ... lb. .0625
Mark II, c.l., f.o.b. Gulf ports ... lb. .0275
c.l., delivered, New York ... lb. .0375
local stock, bags, delivered ... lb. .0625
Standard, c.l., f.o.b. Gulf ports ... lb. .0275
c.l., delivered, New York ... lb. .0375
local stock, bags, delivered ... lb. .0625
W-5, c.l., f.o.b., Gulf ports ... lb. .0275
c.l., delivered, New York ... lb. .0375
local stock, bags, delivered ... lb. .0625
W-6, c.l., f.o.b., Gulf ports ... lb. .0275
c.l., delivered, New York ... lb. .0375
local stock, bags, delivered ... lb. .0625
Paradene No. 2 (drums). lb. .04

Pelletex ... lb. $0.03 /$0.07
Supreme, c.l., f.o.b. Gulf ports ... 100 lbs. 2.75 / 4.75
delivered New York. 100 lbs. 3.75 / 5.75
l.c.l., delivered New York ... 100 lbs. 6.25 / 7.00
"WYEX BLACK" ... lb. .0275/ .0625
Clays
Aerfloted Paragon (50 lb. bags) ... ton 9.50 /22.00
Suprex (50 lb. bags) ... ton 9.50 /22.00
Barden ... lb.
Chicora ... lb.
China ... ton 17.50 /20.00
Crown, f.o.b. (plant) ... ton 9.50
Dixie ... ton 9.50 /24.00
Hi-White, f.o.b. Huber Ga. ... ton 9.50
McNamee ... ton 9.50 /22.00
Par ... ton 9.50 /22.00
Witco, f.o.b. works ... ton 9.50
P-33 ... lb. .0475/ .0775
Thermax ... lb. .0175/ .05
Velvetex ... lb. .022 / .035

Reodorants
Amora A ... lb.
B ... lb.
C ... lb.
D ... lb.
Curodex 19 ... lb. 2.75
188 ... lb. 3.50
198 ... lb. 4.50
Rodo No. 0 ... lb. 3.50 / 4.00
10 ... lb. 4.50 / 5.00

Rubber Substitutes
Black ... lb. .08 / .12
Brown ... lb. .08 / .11
White ... lb. .085 / .125
Factice
Amberex ... lb. .17
Brown ... lb. .07 / .11
Fac-Cel B ... lb. .13
C ... lb. .13
Neophax A ... lb. .095
B ... lb. .095
White ... lb. .09 / .12

Softeners
Bondogen ... lb. .98 / 1.50
Burgundy pitch ... lb. .06
Cycline oil ... gal. .14 / .20
Nuba resinous pitch (drums) Grades No. 1 and No. 2 .. lb. .0265
Nubalene Resin ... lb. .025
Palm oil (Witco), cl. ... lb.
Pine tar ... gal.
Plastogen ... lb. .0775/ .12
R-19 Resin (drums) ... lb. .10
R-21 Resin (drums) ... lb. .10
Reogen ... lb. .115 / .26
Rosin oil, compounded ... gal. .40
RPA No. 1 ... lb. .65
2 ... lb. .65
3 ... lb. .46
Rubtack ... lb. .10
Tackol ... lb. .085 / .18
Tonox ... lb. .52 / .61
Tonox D ... lb. .75 / .85
Witco No. 20 ... gal. .20
X-1 Resinous oil (tank car). lb. .019

Solvents
Beta-Trichlorethane ... gal.
Carbon bisulphide ... lb.
tetrachloride ... lb.
Industrial 90% benzol (tank car) ... gal. .16
Skellysolve ... gal.

Stabilizers for Cure
Laurex, ton lots ... lb.
Stearex B. ... lb.
Beads ... lb.
Stearic acid, single pressed. lb. .10 / .11
Stearite ... 100 lbs. 10.50
Zinc stearate ... lb. .23

Synthetic Rubber
Neoprene Type E ... lb. .65
G ... lb. .70
GW ... lb. .75
H ... lb. .78
M ... lb. .65
Latex Type 57 ... lb. .30

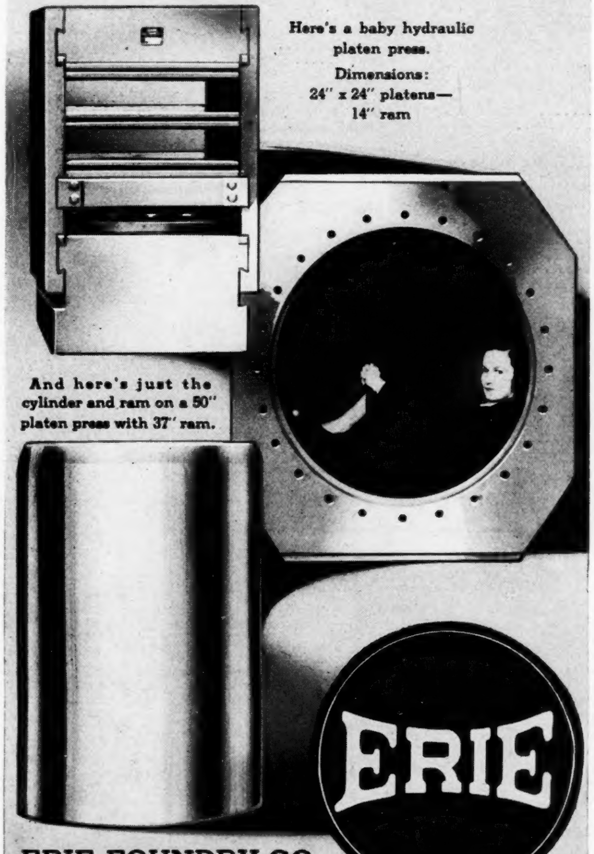
Varnish
Shoe ... gal. 1.45

Vulcanizing Ingredients
Sulphur
Chloride, drums ... lb. .035 / .04
Rubber ... 100 lbs. 2.00
Telloy ... lb. 1.75
Vandex ... lb. 1.75
(See also Colors—Antimony)

Waxes
Carnauba, No. 3 chalky ... lb.
2 N.C. ... lb.
3 N.C. ... lb.
1 Yellow ... lb.
2 ... lb.
Montan, crude ... lb.

SIZE
Means Nothing!

Your requirement for specialized hydraulic presses is the basis from which Erie Foundry designing engineers work . . . thirty-five years of experience enable us to meet your specifications . . . even better, to analyze your production problem, to design and to build specially to lick it. Large—small—medium—put it squarely up to Erie Foundry men . . . You'll be safe . . . and sound.



Here's a baby hydraulic platen press. Dimensions: 24" x 24" platens—14" ram

And here's just the cylinder and ram on a 50" platen press with 37" ram.

ERIE FOUNDRY CO.
ERIE, PA.

Regular and Special Constructions of

COTTON FABRICS

Single Filling Double Filling and

ARMY

Ducks

HOSE and BELTING

Ducks

Drills

Selected

Osnaburgs

Curran & Barry
320 BROADWAY
NEW YORK

COTTON AND FABRICS

NEW YORK COTTON EXCHANGE WEEK-END CLOSING PRICES

Futures	Aug. 26	Sept. 30	Oct. 7	Oct. 14	Oct. 21
Sept.	8.64	....	....	....	....
Oct.	....	9.42	9.24	9.24	....
Dec.	8.43	9.14	8.93	8.99	9.15
Mar.	8.23	8.88	8.75	8.80	9.02
July	7.93	8.48	8.36	8.46	8.77
Sept.	....	....	....	....	8.55

THE cotton market held generally steady during October, the price fluctuating with the tone of the war news from Europe. The New York ⅞-inch spot middling price closed at 9.33¢ per pound on October 2 and, after declining through the first week of the month, regained strength to reach 9.30¢ per pound on October 23. The spot quotation on October 30 was 9.34¢ per pound.

Starting with this month the Cotton Exchange table shown above will give prices for the new cotton contract, based on the delivery of 15/16-inch staple. The above prices for August 26, however, are based on the old contract. Trading on the exchange continues to be done in both contracts.

The Cotton Exchange Service estimated domestic mill consumption in September at 620,000 bales, against 534,000 in September, 1938. Sales of cotton and cotton products under the government's export subsidy program, according to a report by the Agricultural Department, totaled 2,886,000 bales between August 1 and October 14. The sales did not include barter cotton. Actual exports of cotton from August 1 through October 12 were reported at 1,082,469 bales, compared with 828,000 bales during the corresponding period last year.

On October 9 the Crop Reporting Board, Department of Agriculture, estimated cotton production from this year's crop as of October 1 at 11,928,000 bales, down 452,000 bales from the previous month's estimate. Ginnings up to October 1 were reported at 6,686,712 bales.

A hearing was held last month before the Commodity Exchange Administration on the issue of limiting speculative accounts and possibly straddle accounts in the market.

Fabrics

The markets for cotton textiles of coarse yarn construction since the first of October experienced a digestive period with sales volume well under that of September. However orders placed since the war began should keep mills active for the next three or four months. The raincoat business has been very quiet for the past few weeks owing to the lack of rain throughout the country.

Despite the decreased demand the market continues firm with prices of many fabrics showing slight advances over last month's quotations and others holding steady. The prices of raincoat fabrics, however, were somewhat easier.

New York Quotations

October 25, 1939

Drills	
38-inch 2.00-yard ... *yd.*	$0.13
40-inch 3.47-yard	.08
50-inch 1.52-yard	.18¼
52-inch 1.85-yard	.15⅜
52-inch 1.90-yard	.14⅝
52-inch 2.20-yard	13⅝
52-inch 2.50-yard	.12
59-inch 1.85-yard	.15
Ducks	
38-inch 2.00-yard D.F. ... *yd.*	.13
40-inch 1.45-yard S. F.	.18¾
51½-inch 1.35-yard D. F.	.19¼
72-inch 1.05-yard D. F.	.26¾/.29
72-inch 17.21-ounce	.30½
Mechanicals	
Hose and belting ... *lb.*	.30
Tennis	
52-inch 1.35-yard ... *yd.*	.20⅛
Hollands	
Gold Seal and Eagle	
20-inch No. 72 ... *yd.*	.10
30-inch No. 72	.18
40-inch No. 72	.20
Red Seal and Cardinal	
20-inch ... *yd.*	.08½
30-inch	.15¾
40-inch	.17
50-inch	.26
Osnaburgs	
40-inch 2.34-yard ... *yd.*	.11
40-inch 2.48-yard	.10⅜
40-inch 2.56-yard	.09¾
40-inch 3.00-yard	.08⅝
40-inch 7-ounce part waste	.08⅞
40-inch 10-ounce part waste	.12½
37-inch 2.42-yard	.10½
Raincoat Fabrics	
Cotton	
Bombazine 60 x 64 ... *yd.*	.08¾
Plaids 60 x 48	.10½
Surface prints 60 x 64	.11¾
Print cloth, 38½-inch, 60 x 64.	.05½
Sheetings, 40-inch	
48 x 48, 2.50-yard ... *yd.*	.09⅛
64 x 68, 3.15-yard	.08¾
56 x 60, 3.60-yard	.07¾
44 x 40, 4.25-yard	.06½
Sheetings, 36-inch	
48 x 48, 5.00-yard ... *yd.*	.05¼
44 x 40, 6.15-yard	.04⅜
Tire Fabrics	
Builder	
17¼ ounce 60" 23/11 ply Karded peeler ... *lb.*	.29
Chafer	
14 ounce 60" 20/8 ply Karded peeler ... *lb.*	.29
9¼ ounce 60" 10/2 ply Karded peeler ... *lb.*	.28
Cord Fabrics	
23/5/3 Karded peeler, 1-1/16" cotton ... *lb.*	.29½
15/3/3 Karded peeler, 1-1/16" cotton ... *lb.*	.27½
12/4/2 Karded peeler, 1-1/16" cotton ... *lb.*	.26½
23/5/3 Karded peeler, 1¼" cotton ... *lb.*	.35
23/5/3 Combed Egyptian ... *lb.*	.48½
Leno Breaker	
8¼ ounce and 10¼ ounce 60" Karded peeler ... *lb.*	.31

Tire Production Statistics

	Pneumatic Casings		
	Inventory	Production	Shipments
1937	10,383,235	53,309,973	53,485,388
1938	8,451,390	40,182,392	42,330,072
1939			
Jan.	8,932,245	4,581,380	4,163,005
Feb.	9,572,553	4,343,513	3,738,696
Mar.	10,108,584	5,137,030	4,582,656
Apr.	9,997,527	4,211,152	4,355,584
May	9,918,759	4,418,072	4,753,403
June	8,909,495	4,869,862	5,750,149
July	8,300,126	4,510,122	5,055,637
Aug.	8,890,793	5,491,664	4,919,140
Sept.	8,334,660	4,984,505	5,565,356

	Pneumatic Casings		
	Original Equipment	Replacement Sales	Export Sales
1937	22,352,601	29,886,326	1,246,461
1938	10,716,130	30,565,008	1,048,934
1939			
Jan.	1,685,190	2,353,822	123,993
Feb.	1,472,356	2,159,901	106,439
Mar.	1,746,999	2,719,450	116,206
Apr.	1,528,637	2,736,155	90,792
May	1,414,798	3,240,936	97,669
June	1,370,317	4,264,298	98,739
July	808,611	4,160,319	86,707
Aug.	610,771	4,198,410	109,959
Sept.	1,248,773	4,203,887	112,696

	Inner Tubes		
	Inventory	Production	Shipments
1937	10,311,745	52,373,330	52,766,728
1938	8,165,696	37,847,656	40,292,614
1939			
Jan.	8,068,700	4,097,759	3,935,652
Feb.	8,414,652	3,680,521	3,334,791
Mar.	8,900,944	4,470,184	4,015,333
Apr.	8,837,313	3,841,308	3,927,033
May	8,839,536	3,847,827	4,154,390
June	8,043,999	4,319,943	5,123,108
July	7,818,822	4,043,028	4,285,435
Aug.	8,238,406	4,918,165	4,432,396
Sept.	7,630,657	4,462,956	5,018,865

Source: The Rubber Manufacturers Association, Inc. Figures adjusted to represent 100% of the industry.

United States Latex Imports

Year	Pounds (d.r.c.)	Value
1937	51,934,040	$10,213,670
1938	26,606,048	4,147,318
1939		
Jan.	3,589,452	599,927
Feb.	3,844,996	657,565
Mar.	4,491,951	731,302
Apr.	2,279,171	360,739
May	6,240,019	1,067,682
June	4,111,994	694,863
July	6,572,567	1,064,927
Aug.	5,855,400	1,001,013

Data from Leather and Rubber Division, Washington, D. C.

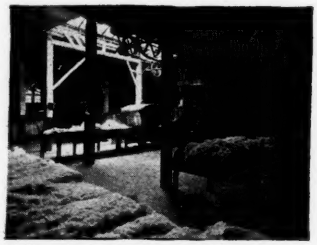
U. S. Crude and Waste Rubber Imports for 1939

	Plantations	Latex	Paras	Africans	Centrals	Guayule	Totals 1939	Totals 1938	Balata	Miscellaneous	Waste
Jan. ... *tons*	36,672	1,521	560	56	9	264	39,082	42,135	61	803	328
Feb.	34,185	1,463	239	348	3	252	36,490	43,930	45	685	54
Mar.	36,434	1,885	229	208	4	229	38,989	35,967	33	649	29
Apr.	27,991	784	487	142	1	196	29,601	30,807	65	275	246
May	44,015	2,167	413	761	7	172	47,535	27,410	78	759	151
June	33,956	1,489	318	42	3	139	35,947	26,011	107	680	7
July	33,211	2,511	456	292	..	269	36,739	22,918	46	884	104
Aug.	34,801	2,260	276	453	2	253	38,045	31,099	46	766	42
Sept.	39,148	2,312	324	..	42	113	41,939	37,374	92	444	8
Total, 9 mos., 1939 ... *tons*	320,413	16,392	3,302	2,302	71	1,887	344,367	......	573	5,945	969
Total, 9 mos., 1938 ... *tons*	284,108	7,919	2,229	1,239	42	2,114	......	297,651	486	6,849	290

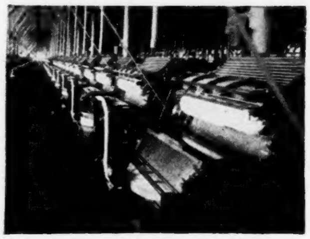
Compiled from The Rubber Manufacturers Association, Inc., statistics.

Our Laboratory Control

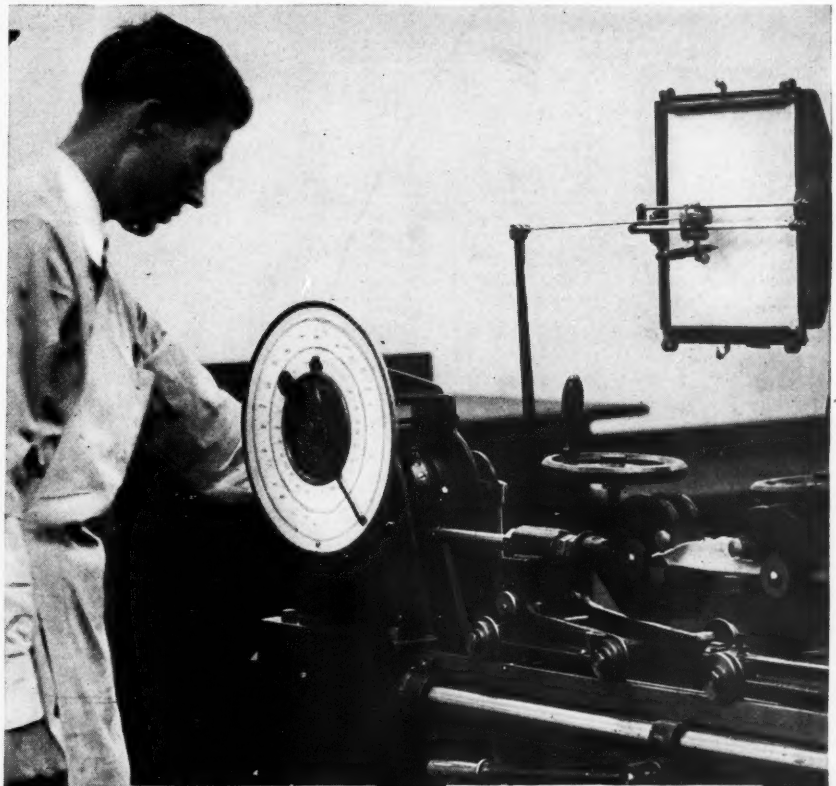
Laboratory analysis determines our selection of the raw cotton that comes to our mills in bales. Bales are graded according to the length and character of the cotton fibre they contain.



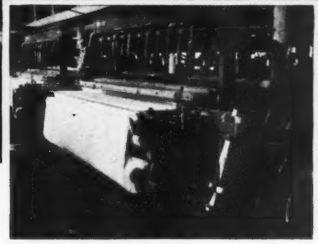
Laboratory reports on thousands of experiments help us determine the proper blend of cotton for a given fabric. Here in the Opener, bales of various grades but the same staple are opened and fed simultaneously to machines that blend, treat and remove foreign matter from the cotton.



Laboratory research and experiment have enabled us to determine the amount of carding the cotton should have to produce yarns from which may be woven properly uniform rubber fabrics.



The roving and spinning operations are subject to constant laboratory check in order that uniform weight and degree of twist may be maintained in the yarn.



Both the processing of our yarns and the weaving of our fabrics are subject to continuous laboratory checking for quality control to assure a high degree of uniformity and conformance to specification.

Produces Reliable Cotton Fabrics for the Rubber Industry

WELLINGTON SEARS COMPANY

65 WORTH STREET, NEW YORK, N. Y.

Rims Approved by The Tire & Rim Association, Inc.

Rim Size	9 Mos., 1939 No.	9 Mos., 1939 %	9 Mos., 1938 No.	9 Mos., 1938 %
Drop Center Rims, 16" Diameter and Under				
16x4.00D	25,771	0.3	7,046	0.2
16x4.50D	1,426	0.0	5,957	0.1
12x2.50C	30,120	0.3	......	...
15x5.50E	151	0.0	......	...
15x3.00D	107,898	1.2	45,808	1.1
15x3.50D	......	...	46	0.0
15x4.50E	20,276	0.2	......	...
15x5.00F	99,679	1.1	15,211	0.4
15x5.50F	119,268	1.3	66,557	1.6
16x3.50D	214,325	2.3	181,672	4.3
16x4.00E	5,123,067	56.2	2,500,103	59.0
16x4.25E	661,436	7.2	102,176	2.4
16x4.50E	1,882,086	20.6	748,975	17.7
16x5.00F	722,791	7.9	419,665	9.9
16x5.50F	13,608	0.1	59,302	1.4
16x6.00F	9,639	0.1	16,958	0.4
Drop Center Rims, 17" Diameter and Over				
17x3.00D	93	0.0	719	0.0
17x3.25E	938	0.0	3,559	0.1
17x3.62F	5,911	0.1	......	...
17x5.00F	539	0.0	167	0.0
18x2.15B	27,259	0.3	18,445	0.4
18x3.00D	2,910	0.0	3,002	0.0
18x3.25E	3,785	0.0	2,089	0.0
18x3.62F	13,161	0.1	11,236	0.3
18x4.00F	4,024	0.0	......	...
18x4.19F	4,472	0.0	7,662	0.1
19x2.15B	......	...	1.099	0.0
19x2.75D	258	0.0	......	0.0
19x3.00D	94	0.0	......	...
19x3.25E	4,264	0.0	248	0.0
20x3.25E	2,196	0.0	3,425	0.1
20x3.62F	......	...	2,662	0.1
21x3.00D	978	0.0	962	0.0
21x3.25E	9,742	0.0	5,157	0.1
22x3.25E	......	...	3,108	0.1
Flat Base Balloon Rims				
All Sizes......	6,199	0.1	3,523	0.1
High Pressure Pasenger Rims				
All Sizes	149	0.0	232	0.0
Clincher Rims				
All Sizes	891	0.0	......	...
15" Truck Rims				
15x5	......	...	144	0.0
15x7	3,786	0.2	3,056	0.3
15x8	1,852	0.1	1,660	0.1
15x9/10	......	...	15	0.0
17" Truck Rims				
17x5	40,015	1.7	45,854	3.9
17x6	39,844	1.7	30,798	2.6
18" Truck Rims				
18x5	444	0.0	59	0.0
18x6	404	0.0	3,368	0.3
18x7	14,528	0.6	11,059	1.0
18x8	12,986	0.6	13,005	1.1
18x9/10	2,934	0.1	2,192	0.2
20" Truck Rims				
20x5	426,999	18.4	227,238	19.2
20x6	950,220	40.9	554,295	46.7
20x7	504,558	21.7	167,425	14.1
20x8	150,230	6.4	49,256	4.1
20x9/10	20,825	0.9	11,083	1.0
20x11	1,543	0.1	2,622	0.2
22" Truck Rims				
22x7	310	0.0	225	0.0
22x8	10,399	0.4	8,091	0.7
22x9/10	4.828	0.2	2,511	0.2
24" Truck Rims				
24x6	5,530	0.2	1,270	0.1
24x7	2,675	0.1	1,555	0.1
24x8	2,259	0.1	3,876	0.3
24x9/10	6,631	0.3	5,686	0.5
24x11	5,428	0.2	2.895	0.2
Semi-drop-base Rims				
16x4.50E	46,036	2.0	7,223	0.6
16x5.50F	67,258	2.9	30,357	2.6
Tractor and Implement Rims				
12x2.50C	4,326	1.5	16	0.0
12x3.00D	7,185	2.5	4,197	1.3
13x5.50F	4,902	1.7	514	0.2
15x3.00D	9,764	3.3	41,123	12.3
15x4.50E	275	0.1	......	...
16x3.00D	5,034	1.7	1,147	0.3
16x5.50F	146	0.1	......	...
16x6.00F	......	...	8,996	2.7
18x3.00D	579	0.2	910	0.3
18x5.50F	17,429	6.0	10,105	3.0
19x3.00D	5,981	2.1	......	...
19x4.00E	170	0.1	......	...
20x4.50E	3,191	1.1	4,123	1.2
20x5.00F	......	...	2,262	0.7
20x5.50F	3,964	1.4	7,673	2.3
21x3.00D	672	0.2	675	0.2
22x4.50E	9,004	3.1	6,464	1.9
24x3.00D	63	0.0	13	0.0
28x4.00E	152	0.1	44	0.0
30x3.00D	108	0.0	......	...
Tractor and Implement Rims (*Cont'd*)				
36x3.00D	1,132	0.4	852	0.3
36x4.00E	87	0.0	......	...
36x4.50E	3,202	1.1	359	0.0
40x3.00D	92	0.0	61	0.0
40x4.00E	......	...	70	0.0
40x4.50E	184	0.0	96	0.0
40x5.50F	......	...	27	0.0
44x4.00E	38	0.0	5	0.0
44x4.50E	205	0.1	......	...
24x5.50R	24,061	8.3	29,242	8.8
32x5.50R	......	...	268	0.1
36x5.50R	9,843	3.4	4,870	1.5
40x5.50R	3,978	1.4	6,537	2.0
20x8.00T	2,091	0.7	944	0.3
24x6.00S	5,389	1.8	3,975	1.2
24x8.00T	46,534	15.8	55,091	16.5
28x6.00S	785	0.3	3,583	1.1
28x8.00T	18,048	6.2	25,174	7.6
32x6.00S	88	0.0	......	...
32x8.00T	7,715	2.7	7,036	2.1
36x6.00S	27,245	9.4	36,711	11.0
36x8.00T	52,305	18.1	52,393	15.7
40x6.00S	12,301	4.3	16,054	4.8
40x8.00T	1,169	0.4	1,064	0.3
42x8.00T	130	0.0	510	0.2
44x8.00T	......	...	170	0.1
Cast Wheels				
10x5.00F	469	29.1	1,281	64.4
10x6.00F	538	33.4	405	20.4
24x13	3	0.2	......	...
24x15	599	37.2	302	15.2
Airplane Rims				
All Sizes	2,566	0.0	575	0.0
Totals	11,735,668		5,759,506	

New Publications

(*Continued from page 63*)

"Don't Play with Fire!" Walter Kidde & Co., Bloomfield, N. J. 8 pages. The various types of Lux carbon dioxide extinguishing equipment for industrial fires are described and illustrated in this booklet. Featured is a new portable extinguisher with a pistol trigger and an overall height of only 16 inches.

"Rhoades Metaline Bronze Oilless Bearings." R. W. Rhoades Metaline Co., Inc., 50-17 Fifth St., Long Island City, N. Y. 16 pages. Metaline bearings described in this catalog require no oil or grease for lubrication and comprise bronze bearings with cylindrical plugs inserted in properly located holes. The plugs which lubricate the bearings are made of a mixture of various metals, metallic oxides, organic salts, graphite, and other materials. The catalog illustrates many types of Metaline bearings and a number of applications for industrial purposes. In the rubber industry these oilless bearings have been used for mill apron roll bearings, heel trimmers, and automatic presses.

"Cotton Production in the United States." United States Department of Commerce, Washington, D. C. For sale by the Superintendent of Documents, Washington, 10¢. 37 pages. The statistical tables in this bulletin for the crop of 1938 include data on: cotton and linter production (1899 to 1938); production by states (1935 to 1938); cotton ginned by states (1935 to 1938); number of ginneries in 1938; cotton ginned by counties (1935 to 1938); average gross weight of the several kinds of bales (1936 to 1938).

Foreign Trade Information

For further information concerning the inquiries listed below address United States Department of Commerce, Bureau of Foreign and Domestic Commerce, Room 734, Custom House, New York, N. Y.

No.	Commodity	City and Country
†3895	Liquid and sheet composition rubber material for making food containers	Brisbane, Australia
‡3896	Fire hose	Oslo, Norway
*3917	Rubber chemicals	Rio de Janeiro, Brazil
*3938	Sporting goods, notions, and toys	Bogota, Colombia
¶3941	Automobile accessories and storage batteries.	Recife, Brazil
*3965	Garage equipment and sporting goods	Capetown, South Africa
*3967	Graphite base jointing material	Santiago, Chile
*3980	Rubber bands, fountain-pen sacks, and surgical sundries	Rio de Janeiro, Brazil
*3986	Toys	Guayaquil, Ecuador
†4008	Tires and tubes	Bogota, Colombia
†4015	Rubber sundries and specialties	Mexico City, Mexico
†4017	Druggists' sundries	London, England
†4027	Elastic webbing	Johannesburg, South Africa
†4030	Tire-retreading machines	Habana, Cuba
*4032	Automobile accessories and parts	Rio de Janeiro, Brazil
†4039	Druggists' sundries	Alexandria, Egypt
*4058	Rubber goods	Bulawayo, Southern Rhodesia
*4074	Rubber thread	Buenos Aires, Argentina
*4079	Rubber goods	Guayaquil, Ecuador
*4084	Belting	Winnipeg, Canada
*4089	Rubberized silk	Mexico City, Mexico
†4099	Elastic thread	Buenos Aires, Argentina
†4130	Air compressors for auto tires	Stockholm, Sweden
†4201	V-belts	Oslo, Norway
*4204	Balls, balloons, and toys	Cairo, Egypt
†4231	Dress shields and rubber thread	Santiago, Chile
†4235	Rubber covered thread.	Dublin, Ireland
†4242	Composition rubber for slipper soles, and latex cement	Dublin, Ireland

*Agency. †Purchase. ‡Purchase and agency. ¶Purchase or agency.

BOOK REVIEW

"Chemical Engineering Catalog." Twenty-fourth Annual Edition, 1939. Published by Reinhold Publishing Corp., 330 W. 42nd St., New York, N. Y. Cloth, 8¼ by 11 inches, 1026 pages. Illustrated. Indexed.

Several hundred firms manufacturing equipment and supplies for chemical and related industries including rubber have contributed information to the latest edition of this standard reference work for the process industries. Catalogs, which are prepared individually by the firms concerned, make up the bulk of the work, but the copy is restricted largely to the presentation of actual technical data. In addition to covering equipment, supplies, industrial chemicals, and raw materials, the book includes sections on: laboratory and reagent chemicals; technical and scientific books; and various charts, tables, and nomographs. The catalog is thoroughly indexed for quick reference purposes.

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Allow nine words for keyed address. *Replies forwarded without charge.*

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CHEMIST, COMPOUNDER, SUPERINTENDENT, OVER TWENTY years' experience in research and development work with old established rubber companies. Wishes connection where initiative can be shown. Mechanical Rubber preferred. Address Box No. 37, care of INDIA RUBBER WORLD.

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(*Advertisements continued on page 79*)

United States Statistics

Imports for Consumption of Crude and Manufactured Rubber

	August, 1939		Eight Months Ended August, 1939	
UNMANUFACTURED—*Free*	Quantity	Value	Quantity	Value
Liquid latex (solids) ..... *lb.*	5,855,400	$1,001,013	36,985,550	$6,178,018
Jelutong or pontianak .... *lb.*	1,662,690	208,156	11,024,268	1,175,143
Balata .... *lb.*	63,726	8,689	877,352	125,965
Gutta percha .... *lb.*	387,619	52,431	2,213,716	329,678
Guayule .... *lb.*	398,000	38,687	3,053,400	273,799
Scrap and reclaimed ..... *lb.*	877,965	10,159	7,528,941	128,618
Totals	9,245,400	$1,319,135	61,683,227	$8,211,221
Misc. rubber (above), 1,000 *lbs.*	9,245	$1,319,135	61,683	$8,211,221
Crude rubber ...... 1,000 *lbs.*	80,178	12,702,958	636,623	99,262,380
Totals .... 1,000 *lbs.*	89,423	$14,022,093	698,306	$107,473,601
Chicle, crude .... *lb.*	168,382	$62,419	11,185,234	$3,906,028
MANUFACTURED—*Dutiable*				
Rubber tires .... *no.*	7,849	$12,483	21,397	$80,302
Rubber boots, shoes, and overshoes .... *prs.*	2,334	413	10,464	3,232
Rubber soled footwear with fabric uppers .... *prs.*	106,225	19,656	558,721	105,483
Golf balls .... *no.*	12,912	1,821	456,989	46,849
Lawn tennis balls .... *no.*	27,808	3,160	1,051,163	113,570
Other rubber balls .... *no.*	200,878	7,247	2,352,358	79,579
Other rubber toys .... *lb.*	14,073	2,268	193,334	30,944
Hard rubber combs ...... *no.*	64,464	4,800	543,249	40,571
Other manufactures of hard rubber	......	1,471	......	17,361
Friction or insulating tape. *lb.*	9,695	2,598	119,608	25,041
Belts, hose, packing, and insulating material	......	4,658	......	50,003
Druggists' sundries of soft rubber	......	2,881	......	41,788
Inflatable swimming belts, floats, etc. .... *no.*	14,224	1,489	533,511	34,099
Other rubber and gutta percha manufactures	......	14,715	......	381,836
Totals	......	$79,660	......	$1,050,658

Exports of Foreign Merchandise

RUBBER AND MANUFACTURES				
Crude rubber .... *lb.*	597,889	$89,741	7,667,786	$1,222,869
Balata .... *lb.*	6,979	1,989	48,079	11,485
Other rubber, rubber substitutes and scrap .... *lb.*	1,955	221	141,310	8,693
Rubber manufactures (including toys)	......	3,185	......	16,752
Totals	......	$95,136	......	$1,259,799

Exports of Domestic Merchandise

RUBBER AND MANUFACTURES				
Reclaimed .... *lb.*	1,887,413	$105,845	14,622,215	$750,747
Scrap .... *lb.*	9,613,676	161,686	72,533,225	1,147,729
Cements .... *gal.*	43,895	52,521	349,723	432,886
Rubberized auto cloth. *sq. yd.*	22,253	10,829	123,182	63,880
Other rubberized piece goods and hospital sheeting.. *sq. yd.*	248,461	85,314	1,892,449	707,579
Boots .... *prs.*	7,847	15,996	60,614	132,536
Shoes .... *prs.*	16,783	18,951	131,494	75,425
Canvas shoes with rubber soles .... *prs.*	42,467	24,466	411,009	276,062
Soles .... *doz. prs.*	2,876	6,500	29,253	62,051
Heels .... *doz. prs.*	32,464	18,388	300,526	165,182
Soling and top lift sheets. *lb.*	37,808	7,063	421,553	82,980
Gloves and mittens.. *doz. prs.*	11,302	21,976	71,047	152,357
Water bottles and fountain syringes .... *no.*	27,763	9,855	175,215	61,814
Other druggists' sundries...	......	64,315	......	442,697
Gum rubber clothing .... *doz.*	20,551	53,285	205,644	458,870
Balloons .... *gross*	21,493	19,832	260,030	200,802
Toys and balls	......	16,926	......	108,201
Bathing caps .... *doz.*	4,395	5,983	41,881	82,119
Bands .... *lb.*	21,373	8,440	178,720	72,913
Erasers .... *lb.*	21,196	12,257	196,979	107,718
Hard rubber goods				
Electrical battery boxes. *no.*	19,471	10,922	132,048	94,860
Other electrical .... *lb.*	17,185	4,031	173,391	49,550
Combs, finished ..... *doz.*	12,900	7,493	105,484	61,209
Other hard rubber goods....	......	17,007	......	107,072
Tires				
Truck and bus casings. *no.*	22,704	464,718	198,497	3,878,759
Other auto casings .... *no.*	64,794	740,641	499,212	5,206,735
Tubes, auto .... *no.*	55,188	89,974	477,951	761,977
Other casings and tubes.. *no.*	12,686	95,347	88,915	678,102
Solid tires for automobiles and motor trucks .... *no.*	216	4,191	2,368	31,452
Other solid tires .... *lb.*	14,437	4,624	133,650	29,839
Tire sundries and repair materials .... *lb.*	217,523	65,352	1,770,747	505,720
Rubber and friction tape.. *lb.*	45,094	14,028	421,290	123,774
Fan belts for automobiles. *lb.*	62,413	38,524	433,306	249,164
Other rubber and balata belts .... *lb.*	276,880	161,446	1,987,255	1,097,706
Garden hose .... *lb.*	70,853	15,301	698,026	146,314
Other hose and tubing .... *lb.*	1,168,327	455,734	4,452,975	1,707,648
Packing .... *lb.*	100,118	46,277	813,322	365,375
Mats, matting, flooring, and tiling .... *lb.*	104,489	15,486	850,618	130,384
Thread .... *lb.*	57,483	48,582	470,985	413,017
Gutta percha manufactures. *lb.*	161,779	46,128	1,052,780	305,843
Other rubber manufactures..	......	151,813	......	1,040,305
Totals	......	$3.218,047	......	$22,569,353

Dominion of Canada Statistics

Imports of Crude and Manufactured Rubber

	June, 1939		Six Months Ended June, 1939	
UNMANUFACTURED	Quantity	Value	Quantity	Value
Crude rubber, etc. .... *lb.*	5,427,072	$837,045	30,625,375	$4,662,985
Latex (dry weight) ...... *lb.*	94,060	18,856	442,847	88,449
Gutta percha .... *lb.*	962	119	8,592	5,966
Rubber, recovered .... *lb.*	941,800	43,323	5,808,800	285,238
Rubber, powdered, and gutta percha scrap .... *lb.*	507,000	7,186	2,659,000	42,457
Balata .... *lb.*	220	42	5,767	1,434
Rubber Substitute .... *lb.*	23,700	6,190	169,600	37,004
Totals	6,995,714	$912,761	39,719,981	$5,123,533
PARTLY MANUFACTURED				
Hard rubber comb blanks...	......	$393	......	$5,198
Hard rubber, n. o. s. .... *lb.*	4,601	2,903	17,180	12,898
Rubber thread not covered. *lb.*	4,179	4,019	27,060	20,174
Totals	8,780	$7,315	44,240	$38,270
MANUFACTURED				
Bathing shoes .... *pairs*	2,406	$733	60,224	$12,885
Belting	......	8,179	......	56,166
Hose	......	11,452	......	60,926
Packing	......	5,685	......	30,390
Boots and shoes .... *pairs*	351	167	13,181	9,212
Canvas shoes with rubber soles .... *pairs*	57,321	24,810	128,860	44,994
Clothing, including waterproofed	......	1,827	......	25,177
Raincoats .... *number*	1,576	5,523	15,432	46,542
Gloves .... *dozen pairs*	351	1,219	3,814	9,883
Hot water bottles	......	155	......	1,663
Liquid rubber compound	......	15,867	......	35,156
Tires, bicycle .... *number*	8,196	4,760	55,260	28,033
Pneumatic .... *number*	3,184	32,883	11,267	141,456
Solid for automobiles and motor trucks .... *number*	23	1,326	101	5,053
Other solid tires	......	1,818	......	5,777
Inner tubes .... *number*	1,158	2,053	3,647	7,957
Bicycle .... *number*	8,796	1,997	18,786	4,209
Mats and matting	......	3,860	......	24,624
Cement	......	6,216	......	31,966
Golf balls .... *dozens*	6,496	14,613	26,288	56,693
Heels .... *pairs*	6,556	368	37,451	2,089
Other rubber manufactures..	......	144,804	......	770,212
Totals	......	$290,315	......	$1,411,063
Totals, rubber imports..	......	$1,210,391	......	$6,572,866

Exports of Domestic and Foreign Rubber Goods

UNMANUFACTURED	Produce of Canada Value	Reexports of Foreign Goods Value	Produce of Canada Value	Reexports of Foreign Goods Value
Waste rubber	$8,152	......	$42,456	......
MANUFACTURED				
Belting	$67,316	......	$361,832	......
Bathing caps	115	......	459	......
Canvas shoes with rubber soles	131,141	......	767,903	......
Boots and shoes	360,908	......	1,752,251	......
Clothing, including waterproofed	58,410	......	282,498	......
Heels	17,265	......	86,821	......
Hose	29,214	......	130,602	......
Soles	16,245	......	94,190	......
Soling slabs	6,052	......	20,985	......
Tires, pneumatic	604,983	......	3,789,154	......
Not otherwise provided for	......	......	42	......
Inner tubes	48,302	......	335,191	......
Other rubber manufactures..	57,290	$1,371	384,071	$21,654
Totals	$1,397,241	$1,371	$8,005,999	$21,654
Totals, rubber exports..	$1,405,393	$1,371	$8,048,455	$21,654

Imports by Custom Districts

	August, 1939 *Crude Rubber		August, 1938 *Crude Rubber	
	Quantity	Value	Quantity	Value
Massachusetts	9,832,917	$1,602,341	8,500,955	$1,219,355
St. Lawrence	7,183	1,291	......	......
Buffalo	26,250	2,850	......	......
New York	55,510,142	8,972,504	55,342,158	6,640,373
Philadelphia	1,176,108	178,732	562,984	51,685
Maryland	2,964,959	448,159	485,099	50,120
Virginia	41,627	6,467	873,600	103,034
Georgia	885,924	125,843	......	......
Mobile	705,390	100,461	276,198	28,296
New Orleans	7,682,906	1,124,076	2,603,405	394,850
Galveston	44,900	6,648	......	......
Los Angeles	6,177,176	962,214	1,869,673	227,108
San Francisco	1,228,225	188,796	817,701	99,367
Oregon	16,800	2,662	11,200	1,664
Michigan	18,421	2,681	......	......
Chicago	112,000	16,852	......	......
Ohio	450	62	56,000	6,682
Colorado	......	......	112,000	16,555
St. Louis	65	19	......	......
Totals	86,431,443	$13,742,658	71,510,973	$8,839,089

*Crude rubber including latex dry rubber content.